Cool LiteRunner-LX800

PC/104 CPU Board

Technical Manual

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Technical Manual Cool LiteRunner-LX800

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Acronyms

AC97	Audio Codec 97
ACPI	Advanced Configuration and Power Management Interface
AES	Advanced Encryption Standard
APM	Advanced Power Management
ATA	Advanced Technology Attachment
BIOS	Basic Input Output System
BPP	Bits Per Pixel
CD	Compact Disc
CF	Compact Flash
COM	Communication Equipment
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CLR	Cool LiteRunner
DAC	Digital-to-Analog-Converter
DDR	Double Date Rate
DMA	Direct Memory Access
DOT	Dynamic Overclocking Technology
EIDE	Enhanced Integrated Device Electronics
EMC	Electromagnetic Compatibility
ETH	Ethernet
FIFO	First In First Out
FPU	Floating Point Unit
FWH	Firmware Hub
GPIO	General Purpose Input Output
HDD	Hard Disk Drive
I²C	Inter-Integrated Circuit
IP	Internet Protocol
IrDA	Infrared Data Association
ISA	Industry Standard Architecture
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LPC	Low Pin Count
LVDS	Low Voltage Differential Signaling
MAC	Media Access Control
MMU	Memory Management Unit
PCI	Peripheral Component Interconnect
PE	Potential Earth
PME	Power Management Event
PHY	Physical Interface
PLL	Phase-Locked Loop
PS/2	Personal System/2
PWR	Power
SMB	System Management Bus
SMC	System Management Controller
SPI	Serial Peripheral Interface
SSD	Solid State Drive
SVGA	Super Video Graphics Array
TCP	Transmission Control Protocol
TFT	Thin-Film Transistor
TLB	Translation Look-aside Buffer
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
UDMA	Ultra-Direct Memory Access
UDP	User Datagram Protocol
VGA	Video Graphics Array
WDOG	Watchdog

1 Overview

1.1 Introduction

The Cool LiteRunner-LX800 (CLR-LX800) is a PC/104 board with AMD's Geode™ LX processor and has a very good performance- power- ratio. The board comprises all peripherals needed for an embedded PC on a small 3.775" by 4.050" printed circuit board. On the top side it is fully plug-in compatible with the Cool LiteRunner 2.

The CLR-LX800 integrates a powerful yet efficient AMD Geode™ LX800 processor together with a CS5536 I/O companion and a Super I/O chip to form a complete PC, with all the standard peripherals already onboard. There is a graphics controller with VGA and LVDS adapters to connect different sorts of display terminals. Backlighting is provided for LCD modules too.

Two fast 100/10BaseT Ethernet ports, two RS232/RS422/RS485 serial ports, one RS485/ IrDA serial port and four USB 2.0 host ports handle the communication with external devices. There are PS/2 connectors for keyboard and mouse as well as a parallel printer port available. An IDE ATA100 adapter allows connection of hard disk or CD drives. Applications that require non-moving storage can use a plugged compact flash in a mounted socket which is connected to the ATA-controller.

System expansion can easily be realized over PC/104 and I²C bus connectors.

The CLR-LX800 is powered by a 5V-only supply and supports ACPI, advanced power management and PCI power management. Security critical applications take advantage of the Geode LX processor, too. It has an on-chip AES 128-bit crypto acceleration block capable of 44 Mbps throughput on either encryption or decryption. The AES block runs asynchronously to the processor core and is DMA based.

The CLR-LX800 runs DOS, Windows, Linux and VxWorks operating systems.

Features

CPU

- AMD Geode™ LX 800@1.0W (500MHz)
- Cache Memory with:
- 64 KB/64 KB level 1 I/D caches
- TLB (Translation Look-aside Buffer):
- 128 KB level 2 cache
- Efficient Prefetch

Chipset

- AMD CS5536 companion device

Interfaces

- 2 x Ethernet 10/100BaseT
- Compact Flash Type III header
- ATA-6 EIDE (Ultra DMA-100)
- PS/2 Keyboard/Mouse
- AC97 Audio ports
- 4 x USB 2.0 ports
- 1 x RS485/IrDA port
- 2 x RS232/RS485, software selectable
- 1 x parallel port

Main Memory

- soldered 256MB DDR400

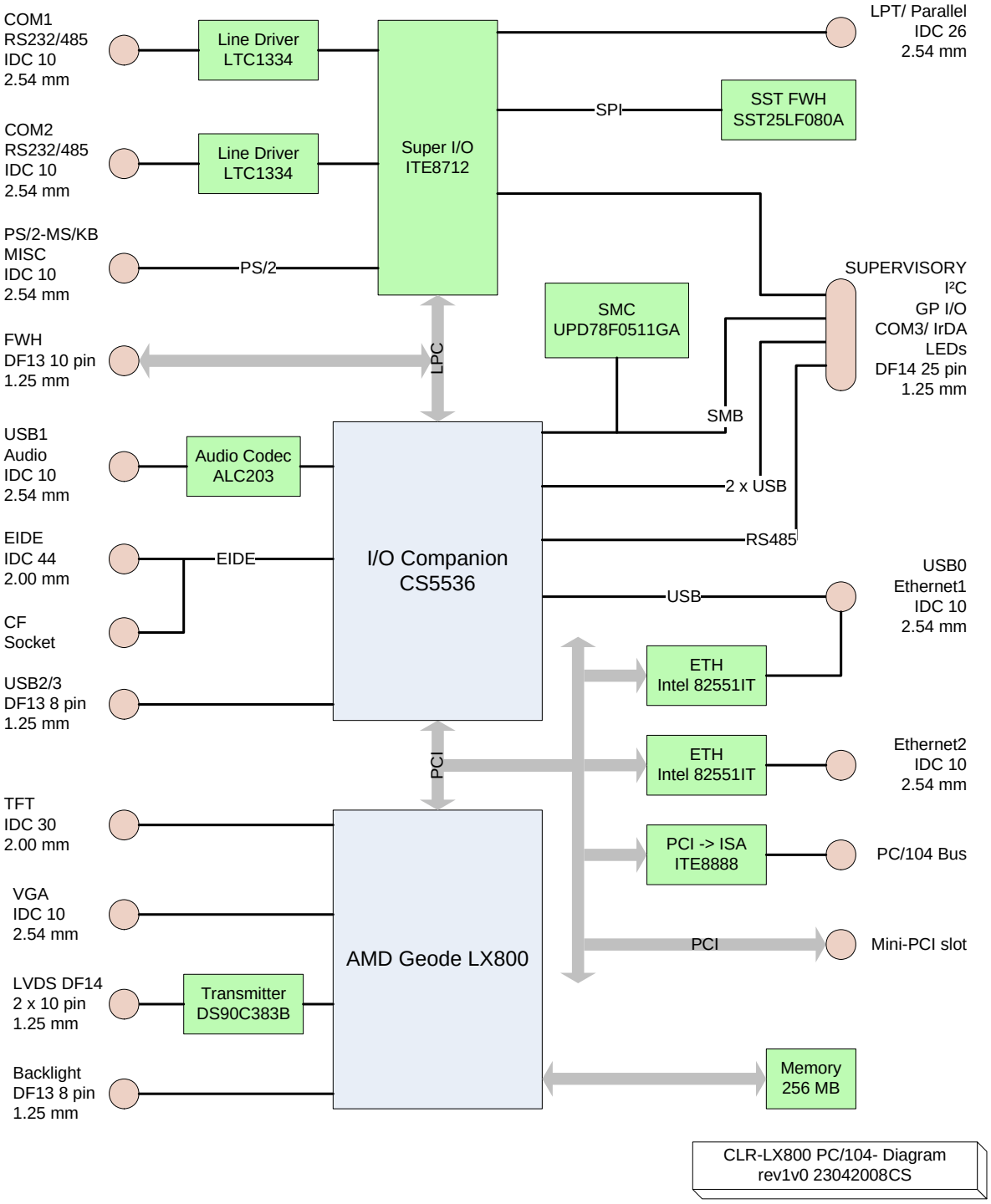
Extension slots

- 1 x 16-bit PC/104 with full DMA capability
- 1 x Mini PCI Slot

- SVGA monitor
- 18 Bit Flat Panel
- 18/24 Bit LVDS for displays
- MISC signals:
  external power button, I²C bus, speaker, external reset button, hardware monitoring and general purpose signals external battery connector
- Power supply

Other configurations are possible at high volumes.

Block Diagram



1.2 Ordering Information

Cool LiteRunner-LX800 Models

Order number	Description
702-0008-10	CLR-LX800 with LCD+VGA-CRT, AMD GEODE LX800@0.9W (500 MHz), low power consumption, 256MB DDR SDRAM, 4x USB2.0, IrDA, RTC, Battery, EIDE, Compact Flash socket, 3x COM, LPT (EPP/EPC), PS/2 Keyboard, PS/2 Mouse, WDOG, LEMT, PC/104 bus, VGA controller and LVDS Interface, 2x Fast Ethernet 100/10BaseT Operating temp. range: 0°C .. +60°C
802-0008-10	CLR-LX800 with LCD+VGA-CRT, AMD GEODE LX800@0.9W (500 MHz), low power consumption, 256MB DDR SDRAM, 4x USB2.0, IrDA, RTC, Battery, EIDE, Compact Flash socket, 3x COM, LPT (EPP/EPC), PS/2 Keyboard, PS/2 Mouse, WDOG, LEMT, PC/104 bus, VGA controller and LVDS Interface, 2x Fast Ethernet 100/10BaseT Operating temp. range: -20°C .. +60°C
902-0008-10	CLR-LX800 with LCD+VGA-CRT, AMD GEODE LX800@0.9W (500 MHz), low power consumption, 256MB DDR SDRAM, 4x USB2.0, IrDA, RTC, Battery, EIDE, Compact Flash socket, 3x COM, LPT (EPP/EPC), PS/2 Keyboard, PS/2 Mouse, WDOG, LEMT, PC/104 bus, VGA controller and LVDS Interface, 2x Fast Ethernet 100/10BaseT Operating temp. range: -40°C .. +85°C

Cable Sets and Accessories

Order number	Description
863-0016-10	Adapter Cable Set Power, PS/2 keyboard and mouse, Audio and USB, Ethernet and USB, Ethernet, VGA-CRT, 2x USB, COM1, COM2, LPT, IDE (44 pin, 2mm), cable adapter 2.5" > 3.5", adapter 3.5" > 2.5"

Mini PCI extension boards

Order number	Description
806-0005-10	Mini-PCI module, 2x firewire port, w/o cable. Operating temp. range: -20°C .. +60°C
806-0006-10	Mini-PCI module, 2x COM (RS232/422/485), 2 cables. Operating temp. range: -20°C .. +60°C

1.3 Specifications

Electrical Specifications

Supply voltage	+5 V DC
Rise time	< 10 ms
Supply voltage tolerance	± 5%**
Inrush current	8 A, 25 µS
Supply current	maximal 1,2 A (Memtest86 v1.70) ** typical 0,84 A (Windows XP idle mode) typical 0,045 A (suspend to ram mode)

Environmental Specifications

Operating:

Temperature range	0 … 60 °C (commercial version)
	-20 … 60 °C (industrial version)
	-40 … 85 °C (extended version)
Temperature change	max. 10K / 30 minutes
Humidity (relative)	10 … 90 % (non-condensing)
Pressure	450 … 1100 hPa

Non-Operating / Storage / Transport:

Temperature range	-40 … 85 °C and more t.b.d.
Temperature change	max. 10K / 30 minutes
Humidity (relative)	5 … 95 % (non-condensing)
Pressure	450 … 1100 hPa

MTBF

MTBF at 25°C	t.b.d.

* With that tolerance it is not mentioned that all plugged devices are running with.

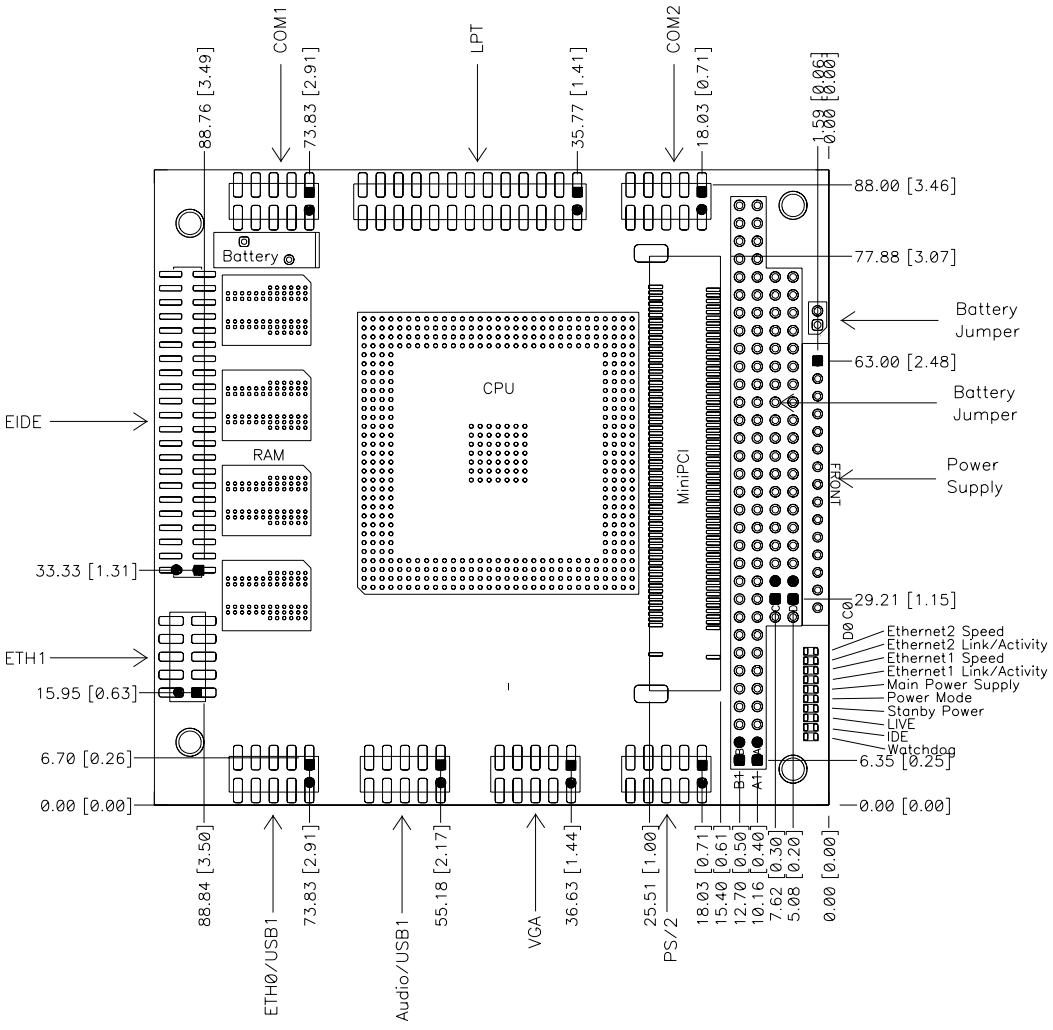
** That rate of current is possible when only monitor, mouse and keyboard are plugged.
If there are connected additional peripheral devises the current rises up.

1.4 Mechanical

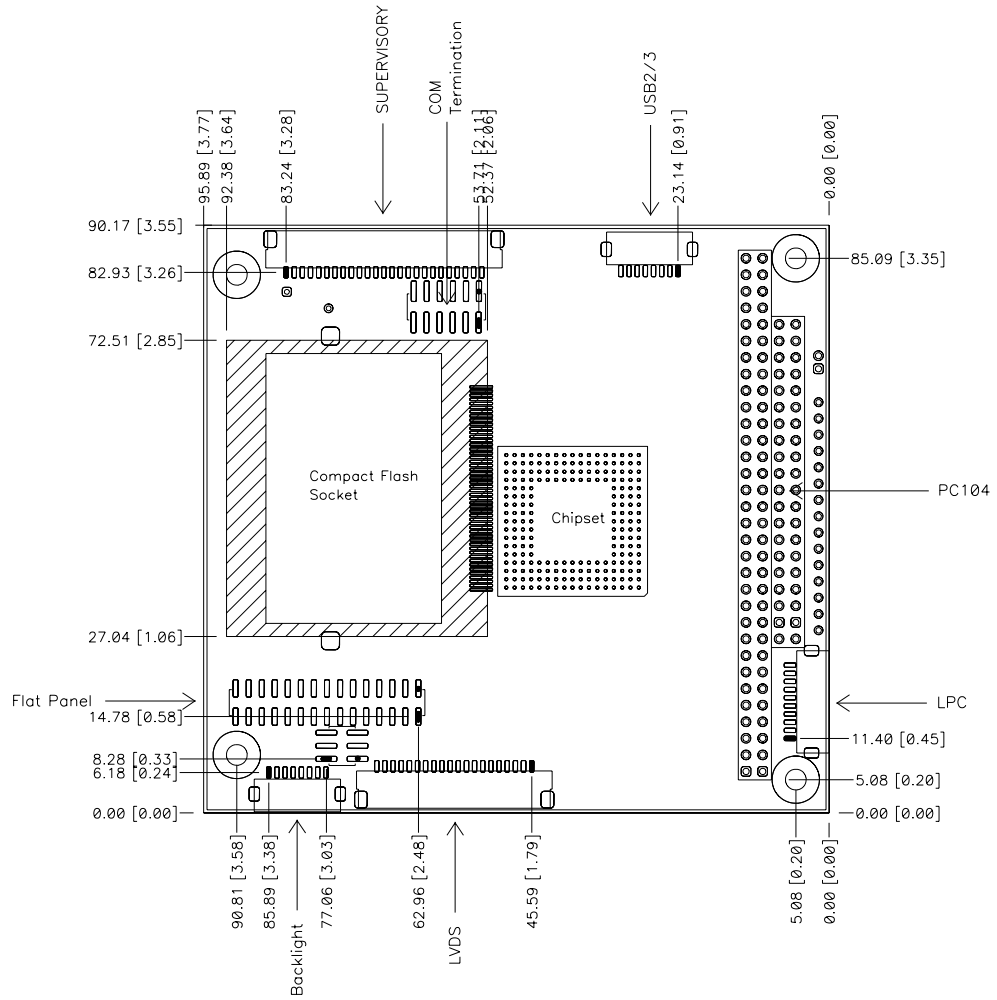
Dimensions (LxW)	95.9 mm x 90.2 mm (including I/O extension)
Height	max. 14 mm on topside above PCB max. 12 mm on bottom side above PCB
Weight	102 gramme
Mounting	4 mounting holes

Note: *It is strongly recommend using plastic spacers instead of metal spacers to mount the board. With metal spacers, there is a possible danger to create a short circuit with the components located around the mounting holes. This can damage the board!*

TOP



BOTTOM (vertical mirrored)

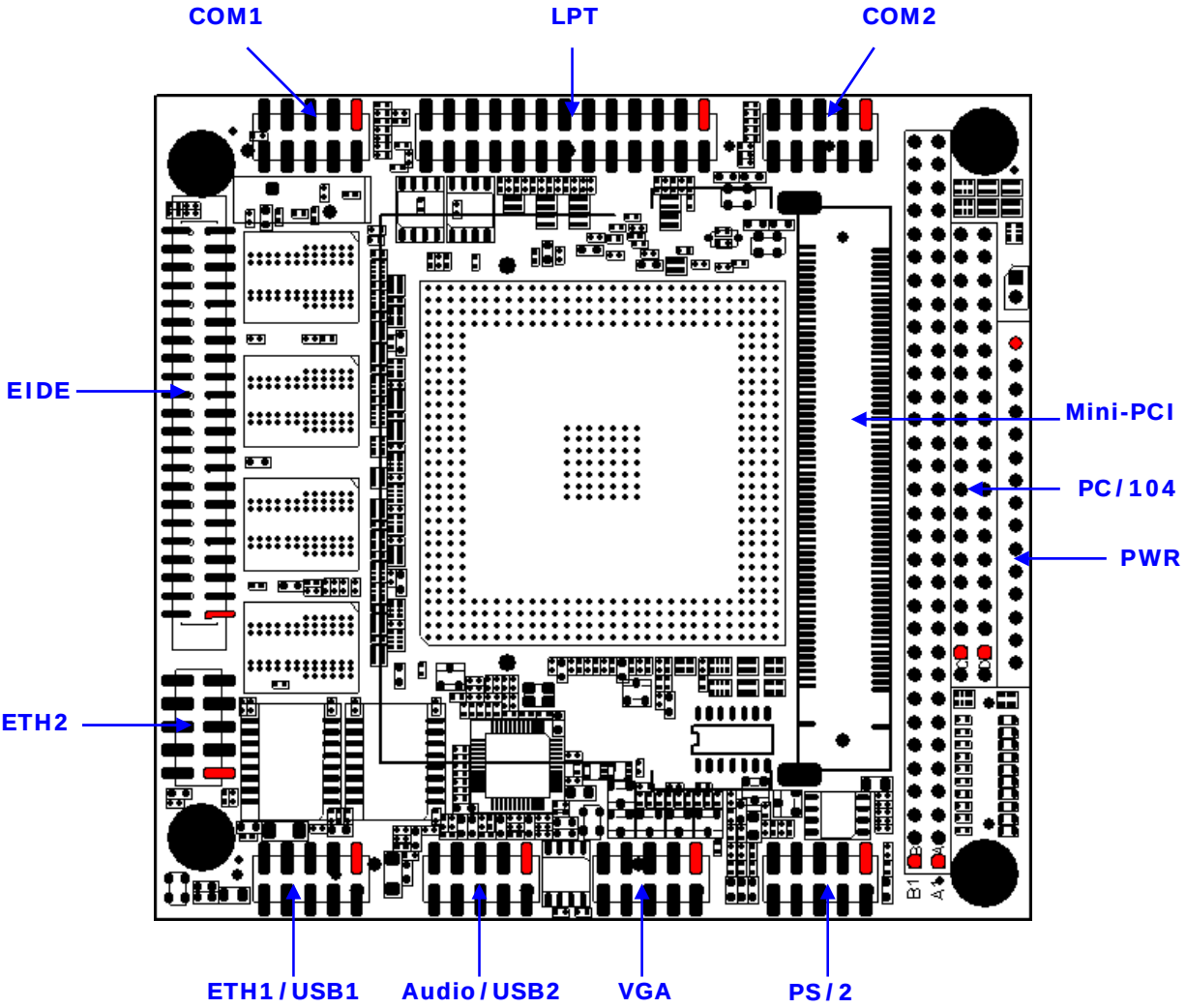


Pin1 ■ Pin2 ●

2 Getting Started

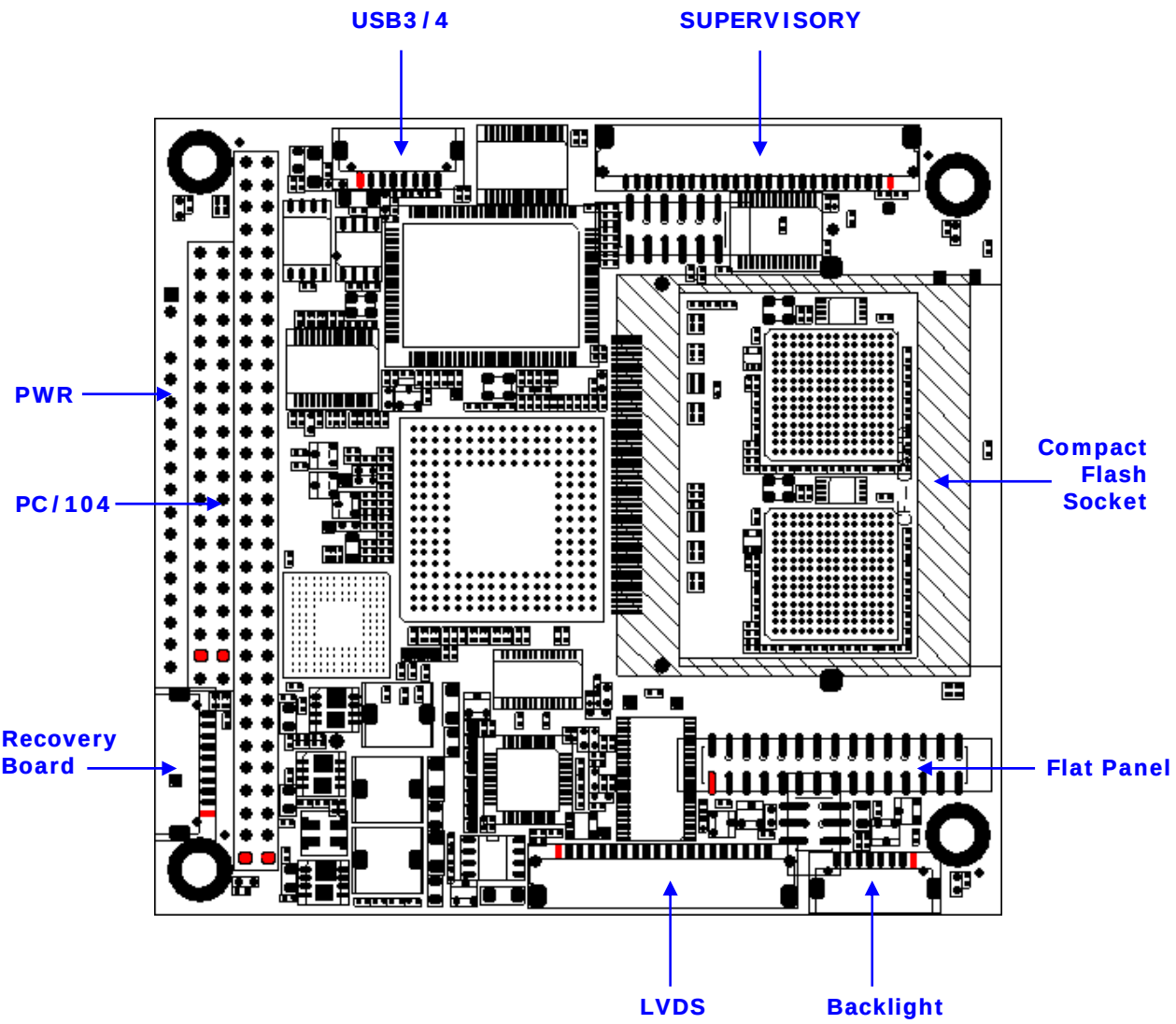
2.1 Connector Locations

Top



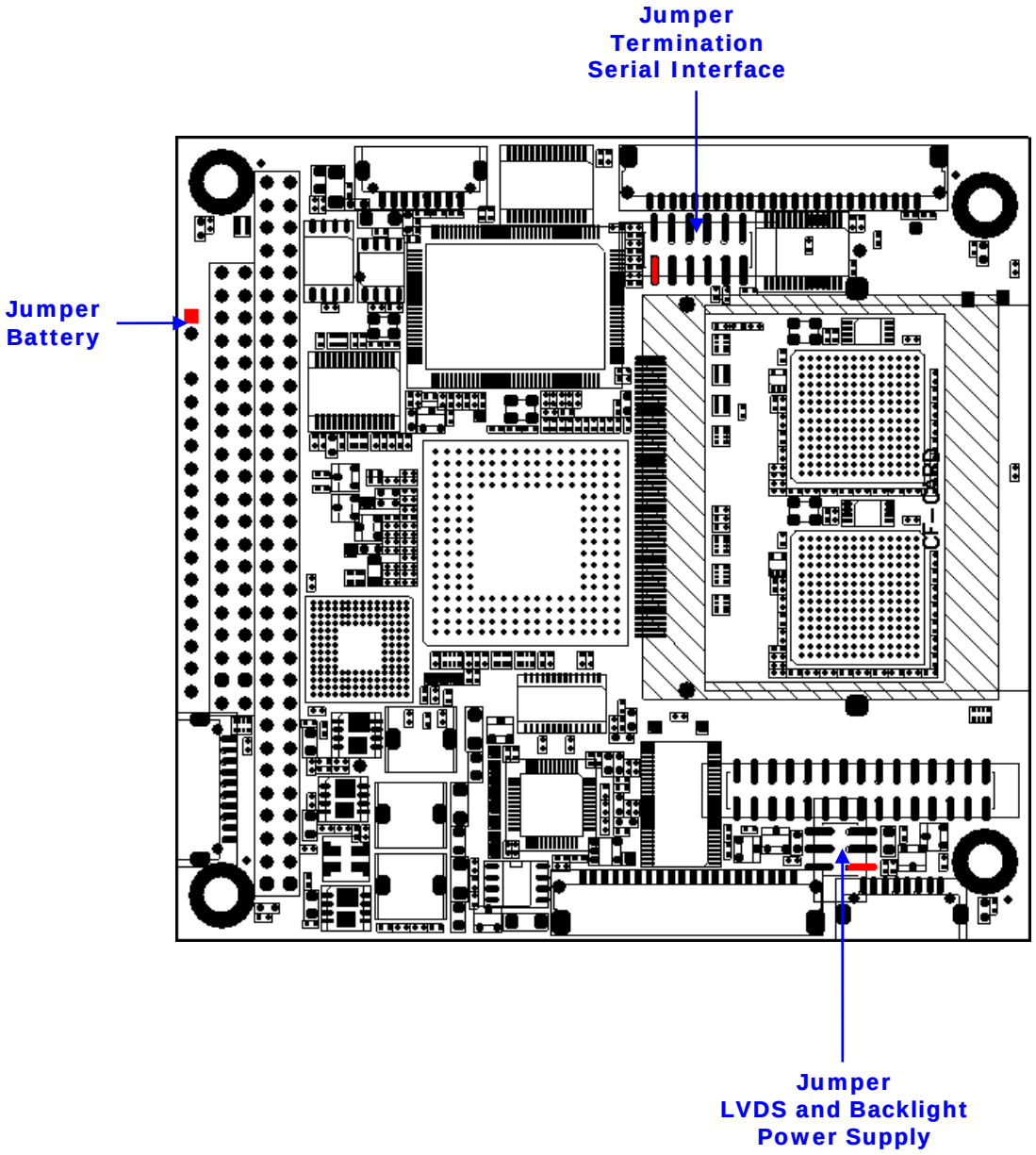
The connectors' pin 1 is marked RED

Bottom



The connectors' pin 1 is marked RED

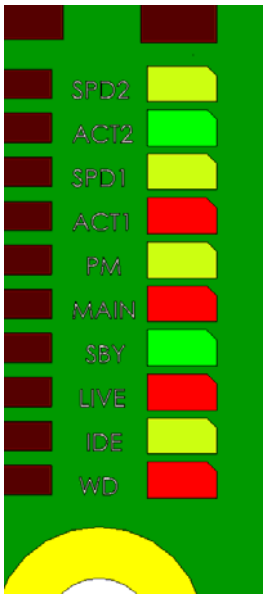
2.2 Jumper Locations



2.3 LED indicators

The onboard LED indicators provide a very comfortable way to check the board's status. The boot success, power status, IDE accesses, Watchdog and Ethernet accesses are all visible.

The LED indicators are located on top of the board, near the PC/104 connector.



SPD2 — Yellow LED lights up if 100Mbit connection of Ethernet 2 is established.

ACT2 — Green LED shows the Ethernet 2 Link and Activity status. The LED lights up when the Link is established and it flashes when there is any activity.

SPD1 — Yellow LED lights up if 100Mbit connection of Ethernet 1 is established.

ACT1 — Green LED shows the Ethernet 1 Link and Activity status. The LED lights up when the Link is established and it flashes when there is any activity.

PM — Power Mode
Red LED is constantly lit if the boot process is complete and the board is running regularly.
Red LED flashes when board goes into suspend mode.

MAIN — Green LED lights up when Main Power is supplied.

SBY — Green LED lights up when Standby Power is supplied.

LIVE — The user programmable LED is on at startup when the board transfers data from the bios. The signal is also located on the SUPERVISORY connector.
Chapter 4.4 shows a small program how to get access for activation.

IDE — Yellow LED flashes when IDE activity is recognized.

WD — Red LED lights up when Watchdog is active.
Can only be reset by a power off.

2.4 Hardware Setup

Caution Be sure to observe the EMC security measures. Make sure you are always at the same potential as the module.

Caution Never connect or disconnect peripherals like HDD-, PCI- and ISA-devices while the board's power supply is connected and switched on!

Use the cable set provided by LiPPERT to connect the Cool LiteRunner-LX800 to a VGA monitor. Connect either PS/2 or USB keyboard and mouse, respectively. Use the 44-wire cable to connect the harddisk. Make sure that the pins match their counterparts correctly and are not twisted! If you plan to use additional other peripherals, now is the time to connect them, too.

Connect a 5 volt, min. 1 amps power supply to the power connector and switch the power on.

Note *The 1 amps value is the minimum you should have for the standard peripherals mentioned. If you want to use more and/or others, please plan your power budget first! The system will not work if there is not enough supply current for all your devices.*

The display shows the BIOS messages. If you want to change the standard BIOS settings, press the <F1> key to enter the BIOS menu. See chapter 4.1 for setup details.

If you need to load the BIOS default values, they can be automatically loaded at boot time. See chapter 4.1 about how to do it.

The Cool LiteRunner-LX800 boots from CD drive, Compact Flash, USB floppy, USB stick, or harddisk. Provided that any of these is connected and contains a valid operating system image, the display then shows the boot screen of your operating system.

The Cool LiteRunner-LX800 does not need any cooling measures, neither at standard environment temperatures from 0 °C … +60 °C nor in the extended range of -40 °C ... +85 °C.

3 Module Description

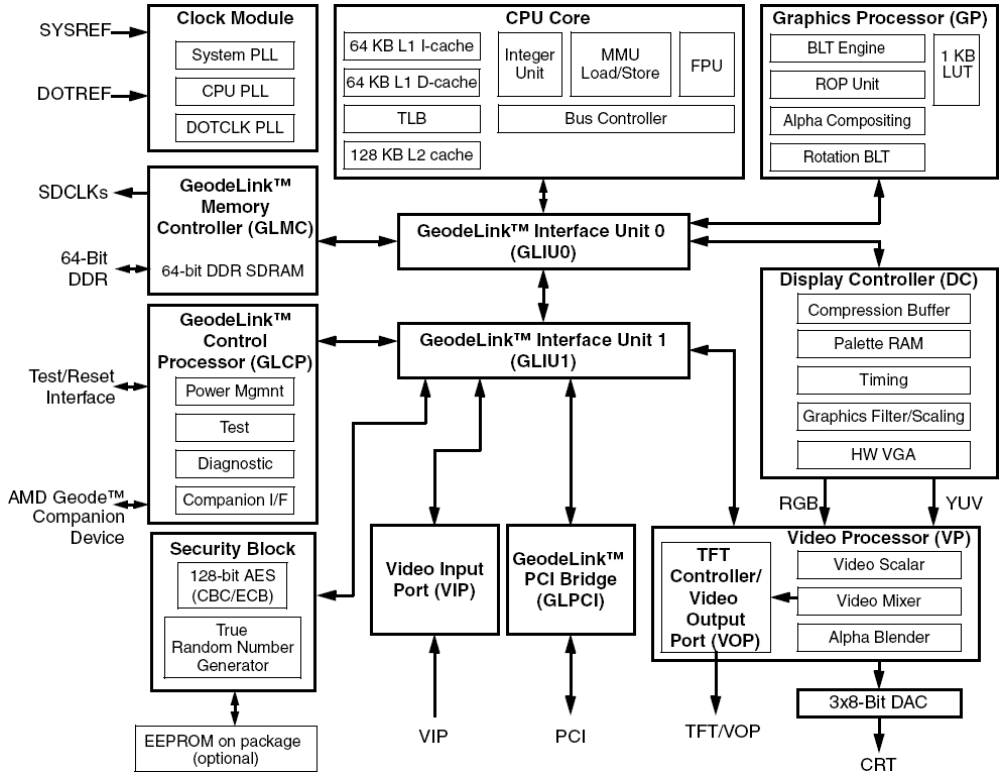
3.1 Processor

The AMD Geode LX 800@0.9W processor delivers one of the best performance per watt in the industry, providing x86 power and versatility to embedded products. Its architecture and high level of integration guarantees longer battery life and allows very small designs, while delivering full x86 functionality.

The AMD Geode LX 800 processor consumes a maximum power of 3.9W and 1.8W typical at 500 MHz, enabling systems that only need to be passively cooled.

The x86 compatibility allow designers to focus on developing end products that efficiently meet consumer needs without being concerned with software porting or compatibility issues.

Coupled with the AMD Geode™ CS5536 companion device, the combined chipset, which operates at 1.9W typical at 433MHz and at 2.4W typical at 500MHz, offers a complete set of features that deliver full desktop functionality to embedded and portable devices.



Internal block diagram of the LX 800 processor

Processor functional blocks are

- CPU Core
- GeodeLink™ Control Processor
- GeodeLink Interface Units
- GeodeLink Memory Controller
- Graphics Processor
- Display Controller
- Video Processor
- Video Input Port

- GeodeLink PCI Bridge
- Security Block

For further information, please refer to the data book of the AMD Geode™ LX 800

3.2 Companion

AMD Geode™ CS5536 companion device

The AMD Geode™ CS5536 companion device is designed to work with an integrated processor North Bridge component such as the AMD Geode™ GX/LX processor. Together, the Geode GX/LX processor and Geode CS5536 companion device provide a system-level solution well suited for the high-performance and low-power needs of a host of embedded devices including digital set-top boxes, mobile computing devices, thin client applications, and single board computers.

The internal architecture uses a single, high-performance modular structure based on GeodeLink™ architecture. This architecture yields high internal speed (over 4 GB/s) data movement and extremely versatile internal power management. The GeodeLink™ architecture is transparent to application software. Communication with the Geode GX/LX processor is over a 33/66 MHz PCI bus.

The Geode CS5536 companion device incorporates many I/O functions, including some found in typical Super-I/O chips, simplifying many system designs. Since the graphics subsystem is entirely contained in the Geode GX/LX processor, system interconnect is simplified. The device contains state-of-the-art power management that enables systems, especially battery powered systems, to significantly reduce power consumption.

Audio is supported by an internal controller, designed to connect to multiple AC97 compatible codecs. An IR (infrared) port supports all popular IR communication protocols. The IR port is shared with one of two industry-standard serial ports that can reach speeds of 115.2 kbps. An LPC (low pin count) port is provided to facilitate connections to a Super-I/O should additional expansion, such as a floppy drive, be necessary, and/or to an LPC ROM for the system BIOS

The hard disk controller is compatible to the ATA-5 specification. The bus mastering IDE controller includes support for two ATA-compliant devices on one channel. The CS5536 companion device provides four Universal Serial Bus (USB) 2.0 compliant ports, supporting low speed, full speed, and high speed connections. All four ports are individually automatically associated with either the Open Host Controller Interface (OHCI) or the Enhanced Host Controller Interface (EHCI) depending on the attached device type. A real-time clock (RTC) keeps track of time and provides calendar functions.

A suite of 82xx devices provides the legacy PC functionality required by most designs, including two PIC's (programmable interrupt controllers), one PIT (programmable interval timer) with three channels, and DMA (direct memory access) functions. The CS5536 companion device contains eight MFGPT's (multi-function general purpose timers) that can be used for a variety of functions. A number of GPIO's (general purpose input/outputs) are provided, and are assigned to system functions on power-up.

State-of-the-art power management features are attained with the division of the device into two internal power domains. The GPIO's and multi-function timers are distributed into each domain allowing them to act as wakeup sources for the device. The device provides full ACPI (Advanced Configuration Power Interface) compliance and supports industry-standard Wakeup and Sleep modes.

3.3 Graphics-Controller

The graphics controller is integrated in the Geode LX processor and does high performance 2D-graphics handling. CRT monitors can be used as well as TFT- and LVDS displays. Therefore, two different connectors are on the board. It is possible to switch between CRT and TFT via BIOS or driver settings. It is possible to use a CRT and a TFT/LVDS display simultaneously (depends on drivers setting).

The CLR-LX800 supports 3,3V and 5V TFT displays up to 18bit and LVDS displays with 18/24bit interfaces and unconventional signal configuration. The display type and resolution can be selected in BIOS setup:

Motherboard Device Configuration → Video and Flat Panel Configuration.

SVGA Configuration

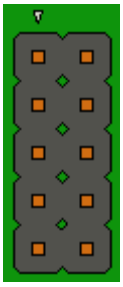
Resolution	Color Depth (bpp)	Refresh Rate (Hz)	Dot Clock (MHz)	Min. GLIU Frequency (MHz)
640 x 480	8, 16, or 24/32	60	25.175	75
	8, 16, or 24/32	70	28.560	75
	8, 16, or 24/32	72	31.500	75
	8, 16, or 24/32	75	31.500	75
	8, 16, or 24/32	85	36.000	75
	8, 16, or 24/32	90	37.889	400
	8, 16, or 24/32	100	43.163	400
800 x 600	8, 16, or 24/32	60	40.000	75
	8, 16, or 24/32	70	45.720	75
	8, 16, or 24/32	72	49.500	75
	8, 16, or 24/32	75	49.500	75
	8, 16, or 24/32	85	56.250	75
	8, 16, or 24/32	90	60.065	400
	8, 16, or 24/32	100	68.179	400
1024 x 768	8, 16 or 24/32	60	65.000	75
	8, 16, or 24/32	70	75.000	100
	8, 16, or 24/32	72	78.750	100
	8, 16, or 24/32	75	78.750	100
	8, 16, or 24/32	85	94.500	100
	8, 16, or 24/32	90	100.187	400
	8, 16, or 24/32	100	113.310	400
1152x864	8, 16, or 24/32	60	81.600	100
	8, 16, or 24/32	70	97.520	100
	8, 16, or 24/32	72	101.420	200
	8, 16, or 24/32	75	108.000	200
	8, 16, or 24/32	85	119.650	200
	8, 16, or 24/32	90	129.600	400
	8, 16, or 24/32	100	144.000	400

Resolution	Color Depth (bpp)	Refresh Rate (Hz)	Dot Clock (MHz)	Min. GLIU Frequency (MHz)
1280 x 1024	8, 16, or 24/32	60	108.000	200
	8, 16, or 24/32	70	129.600	200
	8, 16, or 24/32	72	133.500	200
	8, 16, or 24/32	75	135.000	200
	8, 16, or 24/32	85	157.500	200
	8, 16, or 24/32	90	172.800	400
	8, 16, or 24/32	100	192.000	400
1600 x 1200	8, 16, or 24/32	60	162.000	200
	8, 16, or 24/32	70	189.000	200
	8, 16, or 24/32	72	198.000	233
	8, 16, or 24/32	75	202.500	233
	8, 16, or 24/32	85	229.500	266
	8, 16, or 24/32	90	251.182	400
	8, 16, or 24/32	100	280.640	400
1920x1440	8, 16, or 24/32	60	234.000	266
	8, 16, or 24/32	70	278.400	400
	8, 16, or 24/32	72	288.000	400
	8, 16, or 24/32	75	297.000	400
	8, 16, or 24/32	85	341.349	400

VGA Connector

Connector type IDC10 pin header 2.54 mm

Pin	Signal	Pin	Signal
1	Red	2	GND
3	Green	4	GND
5	Blue	6	GND
7	HSYNC	8	GND
9	VSYNC	10	GND



Flat Panel and LVDS Configuration

Flat panel and LVDS have the same display options as shown in the table:

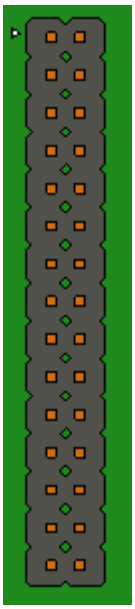
Setting	Possible Values
Flat Panel Type	Auto, TFT, LVDS
Resolution	320x240, 640x480, 800x600, 1024x768, 1152x864, 1280x1024, 1600x1200
Data Bus Type	18/24 Bits, 2ppc
Refresh Rate	60 70, 72, 75, 85, 90, 100 Hz
HSYNC Polarity	High, Low
VSYNC Polarity	High, Low
LP Active Period	Active Only → only active during SYNC Free Running → always active
SHFCLK Active Period	Active Only → only active during SYNC Free Running → always active

To ease usage of these displays it's possible to select the display and backlight supply voltages with the onboard voltage selector jumpers. (Jumper LVDS and Backlight, see below)

Flat Panel Connector 18 Bit

Connector type IDC30 pin header 2.00 mm

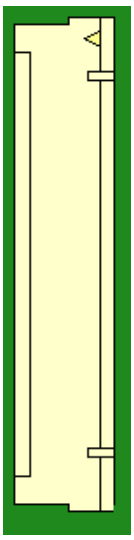
Pin	Signal	Pin	Signal
1	GND	2	DOTCLK
3	HSYNC	4	VSYNC
5	GND	6	R0
7	R1	8	R2
9	R3	10	R4
11	R5	12	GND
13	G0	14	G1
15	G2	16	G3
17	G4	18	G5
19	GND	20	B0
21	B1	22	B2
23	B3	24	B4
25	B5	26	GND
27	EN	28	VLCD-SW
29	VLCD-SW	30	GND



LVDS Connector

Connector type Hirose DF13 20-pin header, single row

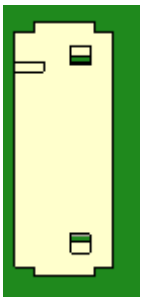
Pin	Signal	Pin	Signal
2	SW-VDD	1	SW-VDD
4	GND	3	GND
6	TX3+	5	TX3-
8	TXCLK-	7	GND
10	GND	9	TXCLK+
12	TX2+	11	TX2-
14	TX1-	13	GND
16	GND	15	TX1+
18	TX0+	17	TX0-
20	DDC DATA	19	DDC CLK



Backlight Connector

Connector type Hirose DF13 8 pin, single row

Pin	Signal
1	+12 Volts
2	+12 Volts
3	+5 Volts
4	+5 Volts
5	ENABLE
6	VCC*
7	GND
8	GND



*That voltage can be selected over Jumper Backlight, shown on next page

Display Voltage Jumpers

Jumper LVDS and Backlight

Connector type IDC6 jumper 2.00 mm.

Use a 2 mm jumper between 1-3 or 3-5 to select the backlight voltage.

Use a 2 mm jumper between 2-4 or 4-6 to select the display voltage.

Pin	Signal	Pin	Signal
1	+12 volts	2	+5 volts
3	Backlight voltage	4	Display voltage
5	+ 5 volts	6	+3.3 volts

default jumper setting

Backlight		
Jumper	1-3	3-5
Power supply	+12V	+5V
LVDS		
Jumper	2-4	4-6
Power supply	+5V	+3.3V

Note An arrow marks Pin 1

3.4 Compact Flash Socket

On the bottom side of the board a compact flash socket is located that allows the use of compact flash cards instead of a hard disk. This socket is connected to the chipset's EIDE port. As default it is defined as Master. Master/Slave selection can be done in BIOS.
Compact flash cards are available as solid-state disks up to several Gbytes.

With the supported UDMA-4 mode and the latest CF cards there are data rates up to 40MByte/s possible.

3.5 Ethernet Controller

On the board there are two Intel 82551IT Fast Ethernet Controllers mounted.

The 82551IT is an evolutionary addition to Intel's family of 8255x controllers. It provides excellent performance by offloading TCP, UDP and IP checksums and supports TCP segmentation off-load for operations such as Large Send. The 82551IT provides an extended operating temperature in addition to all of the same capabilities and features as the 82551ER to address applications requiring a wider operating temperature range.

Its optimized 32-bit interface and efficient scatter-gather bus mastering capabilities enable the 82551IT to perform high speed data transfers over the PCI bus. This capability accelerates the processing of high level commands and operations, which lowers CPU utilization. Its architecture enables data to flow efficiently from the bus interface unit to the 3 KB Transmit and Receive FIFO's, providing the perfect balance between the wire and system bus. In addition, multiple priority queues are provided to prevent data underruns and overruns.

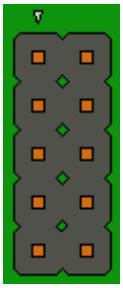
The 82551IT includes both a MAC and PHY. In also has a simple interface to the analog front end, which allows cost effective designs requiring minimal board real estate. The 82551IT is pin compatible with the 82559 family of controllers and is offered with software that provides backwards compatibility with previous 8255xER controllers.

Ethernet Interface

The Ethernet 1 connector is shared with USB 1 and I²C bus.

Connector type IDC10 pin header 2.54 mm

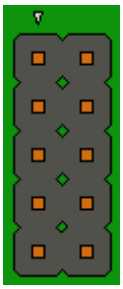
Pin	Signal	Pin	Signal
1	ETH1-TX+	2	ETH1-TX-
3	ETH1-RX+	4	PE
5	PE	6	ETH1-RX-
7	USB0+	8	USB0-
9	VCC_USB0	10	USB-GND



The Ethernet 2 connector uses a single connector

Connector type IDC10 pin header 2.54 mm

Pin	Signal	Pin	Signal
1	ETH2-TX+	2	ETH2-TX-
3	ETH2-RX+	4	PE
5	PE	6	ETH2-RX-
7	PE	8	PE
9	n.c.	10	n.c.



3.6 On Board Power Supply

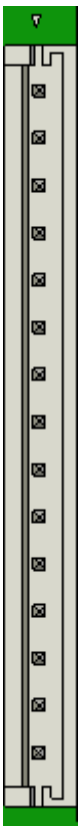
The on board power supply generates all necessary voltages from the single supply voltage of 5 volts. The generated 3.3 volts are available on the connectors "Flat Panel" and "LVDS".

Note *This 3.3 V must not be used to supply external electronic devices with high power consumption like other PC/104 boards or displays.*

Power Connector

Connector type JST B15B-EH-A 15 pin

Pin	Signal (standard)	Signal (5V only)
1	+5V	+5V
2	GND	GND
3	+5V	+5V
4	GND	GND
5	+5V	+5V
6	n.c.	n.c.
7	GND	GND
8	GND	GND
9	n.c.	n.c
10	n.c.	n.c
11	GND	GND
12	+12V (only for PC104 slot and backlight power supply)	n.c
13	+12V (only for PC104 slot and backlight power supply)	n.c
14	GND	GND
15	-12V (only for PC104 slot)	n.c



Note *The default cable adapter supports the connection of ±12V power supply.*
If the 5V only power supply is required leave these pins open.
The board can also be supplied over PC/104- or PC/104 plus bus.

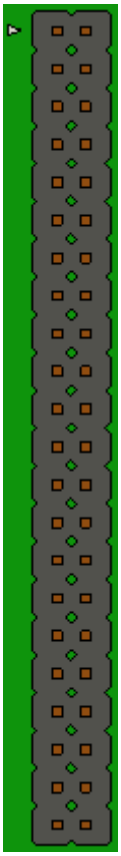
3.7 EIDE Port

An EIDE (**E**nhanced **I**ntegrated **D**rive **E**lectronics) port is provided by the chipset to connect one drive. The connected device must be set as slave.
To enhance the performance, this port has a 100 MB/s IDE controller in UDMA mode per the ATA-5 specification The EIDE port is available on a standard 44-pin header (2 mm) for 2.5" hard disks.
An adapter cable is available to connect standard EIDE devices with a 40 pin IDC header.

EIDE Connector

Connector type IDC44 pin header 2.00 mm

Pin	Signal	Pin	Signal
1	Reset#	2	GND
3	Data7	4	Data8
5	Data6	6	Data9
7	Data5	8	Data10
9	Data4	10	Data11
11	Data3	12	Data12
13	Data2	14	Data13
15	Data1	16	Data14
17	Data0	18	Data15
19	GND	20	NC
21	DRQ0	22	GND
23	Write	24	GND
25	Read	26	GND
27	Ready	28	CSEL
29	DACK0	30	GND
31	IRQ	32	IOCS16-
33	Address1	34	PD66
35	Address0	36	Address2
37	CS1	38	CS3
39	NC	40	GND
41	+5 Volts	42	+5 Volts
43	GND	44	GND



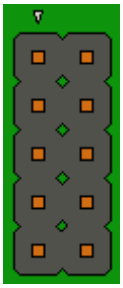
3.8 PS/2 Interface

PS/2-connectors for mouse and keyboard are shared with several system signals.
An adapter cable for the PS/2 devices is available.

Keyboard and Mouse Connector

Connector type IDC10 pin header 2.54 mm

Pin	Signal	Pin	Signal
1	Speaker	2	Mouse Clock
3	Reset-In	4	Mouse Data
5	KB Data	6	KB Clock
7	GND	8	+5 Volt Standby
9	Ext. Battery	10	Reset-In/ Power Button



3.9 USB 2.0 Ports

Four standard USB 2.0 host ports are provided at the with CLR-LX800. The first is located on the IDC10 header "Ethernet" and the second on the IDC10 header "Audio"

The other two ports are located on the separate DF13 8 pin header "USB".

An adapter cable for all ports is available to use standard USB devices

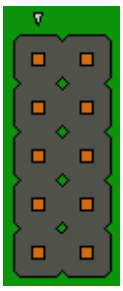
It is possible to use an USB keyboard under MSDOS without special driver software.

Note: *Not all USB keyboard models are supported.*

USB 2.0 Connector 1

Connector type IDC10 pin header 2.54 mm

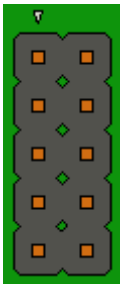
Pin	Signal	Pin	Signal
1	ETH1-TX+	2	ETH1-TX-
3	ETH1-RX+	4	PE
5	PE	6	ETH1-RX-
7	USB1+	8	USB1-
9	VCC_USB1	10	USB-GND



USB 2.0 Connector 2

Connector type IDC10 pin header 2.54 mm

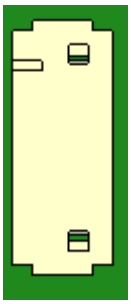
Pin	Signal	Pin	Signal
1	USB2+	2	USB2-
3	VCC_USB2	4	USB-GND
5	LINEIN-L	6	LINEIN-R
7	LINEOUT-L	8	LINEOUT-R
9	MICROPHON	10	GND-AUDIO



USB 2.0 Connector 3/4

Connector type DF13 8 pin header 1.25 mm

Pin	Signal
1	VCC_USB3
2	USB3-
3	USB3+
4	USB-GND
5	USB-GND
6	USB4-
7	USB4+
8	VCC_USB4



3.10 Serial Ports

The serial ports are located on two IDC10 headers "COM1" and "COM2". Adapter cables with standard DSUB-9 male connectors are available. The ports either work in RS232 or RS485 mode, selectable in BIOS. When entering **Motherboard Device Configuration → Serial and Parallel Device Configurations**, **COM Port 1 Mode** and **COM Port 2 Mode** can be selected. Termination resistors for RS485 Mode can be set with Jumpers on pin headers as described in this chapter.
To enable transmitters of COM1 and COM2 in RS485 Mode set RTS signal to '1'.

The third serial Port is located at the supervisory connector see chapter 3.18.

COM Port 3 is a RS485-only interface and can be used in 2-wire and in 4-wire systems. In 2-wire systems only Half Duplex is possible, whereas in 4-wire systems both, Half- and Full-Duplex, mode can be used. In 2-wire systems or 4-wire systems with more than 1 transmitter the transmitter must be disabled in receive mode, and enabled in transmit mode. See chapter 4.3 for an example.

The serial ports are programmable in BIOS setup. When entering **Motherboard Device Configuration → Serial and Parallel Device Configurations,** configuration of the serial ports is accessible.

The following settings are possible for COM1 and COM2:

- Disabled
- 3F8 / IRQ4 (base address / interrupt channel)
- 2F8 / IRQ3 (base address / interrupt channel)
- 3E8 / IRQ4 (base address / interrupt channel)
- 2E8 / IRQ3 (base address / interrupt channel)

The following for COM3:
base address

- Disabled
- 3F8
- 2F8
- 3E8
- 2E8

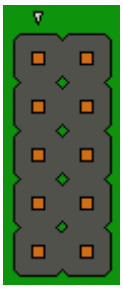
interrupt channel

- IRQ5
- IRQ6
- IRQ7
- IRQ9
- IRQ10
- IRQ11
- IRQ15

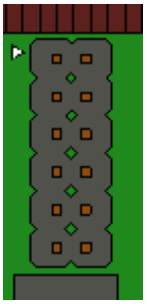
COM1/2

Connector type IDC10 pin header 2.54 mm

Pin	RS232	RS485	Pin	RS232	RS485
1	DCD	*Not used*	2	DSR	RXD+
3	RXD	RXD-	4	RTS	TXD+
5	TXD	TXD-	6	CTS	*Not used*
7	DTR	*Not used*	8	*Not used*	*Not used*
9	GND	GND	10	+5 Volts	+5 Volts



RS485-Termination Jumpers



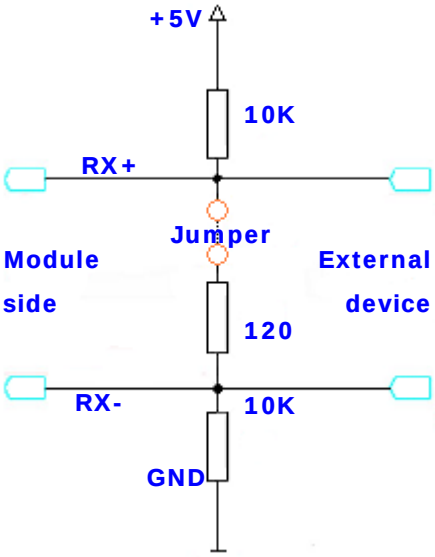
Connector type IDC12 pin header 2.00 mm

Use 2 mm jumpers to terminate lines correctly.

There are two jumpers COM1 and COM2, respectively.

The RS485 termination jumpers are located at the bottom of the printed circuit board, see chapter 2.2

Pin	Signal	Pin	Signal
1	TX+_COM1	2	TX-_COM1
3	RX+_COM1	4	RX-_COM1
5	TX+_COM2	6	TX-_COM2
7	RX+_COM2	8	RX-_COM2
9	TX+_COM3	10	TX-_COM3
11	RX+_COM3	12	RX-_COM3



When the jumper is set, the differential pairs are terminated with 120Ω between them. (e.g. RX+ and RX-, on the right picture)

Additionally, positive/negative receive lines are pulled up/down with 10kΩ to 5V/GND in order to protect the transceivers of the Cool LiteRunner-LX800 from over voltages.

It is recommended to protect the ports of the external device in the same way!

Caution: Termination Resistors **should not** be used in RS232 Mode! Otherwise, the serial ports will not work.

3.11 IrDA Interface

The IrDA interface signals IRRX and IRTX are located on the supervisory connector, see chapter 3.18. The IrDA interface shares its UART with COM3, the normal serial port 3 cannot be used at the same time as the IrDA interface.

To use the IrDA interface an external transmitter must be connected to the IrDA signals and the in BIOS IrDA mode has to selected.

3.12 Parallel Port LPT1

The parallel port is located on an IDC26 header. An adapter cable with a standard DSUB-25 female connector is available.

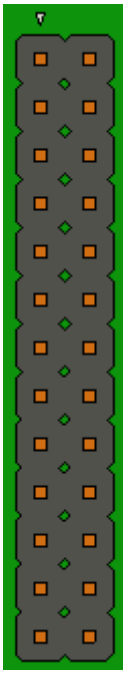
The parallel port is programmable in BIOS.
Entering **Motherboard Device Configuration → Serial and Parallel Device Configurations**, configuration of LPT1 is accessible.

LPT1 Parameter	Possible Settings
Base Address	Disabled, 0x378 0x3BC and 0x278 are not recommended, because of a possible conflict with the PCI to ISA Bridge
Mode	Compatible, PS/2 Bi-directional, EPP 1.7, EPP 1.9
IRQ	Disabled, IRQ 5, IRQ 7, IRQ 9, IRQ 10, IRQ 11
DMA	None, Channel 1, Channel 3

LPT1 Connector

Connector type IDC26 pin header 2.54 mm

Pin	Signal	Pin	Signal
1	Strobe	2	Auto LF
3	Data0	4	Error
5	Data1	6	Init
7	Data2	8	Select In
9	Data3	10	GND
11	Data4	12	GND
13	Data5	14	GND
15	Data6	16	GND
17	Data7	18	GND
19	ACK	20	GND
21	Busy	22	GND
23	Paper End	24	GND
25	Select	26	+5V Standby



3.13 LEMT functions

The onboard Microcontroller implements power sequencing and LEMT (**L**iPPERT **E**nhanced **M**anagement **T**echnology) functionality. The microcontroller communicates via the System Management Bus with the CPU/Chipset. The following functions are implemented:

- Total operating hours counter
  Counts the number of hours the module has been run in minutes.
- On-time minutes counter
  Counts the seconds since last system start.
- Power cycles counter
- Watchdog Timer
  Set / Reset / Disable Watchdog Timer.
- System Restart Cause
  Power loss / Watchdog / External Reset.
- Flash area
  1kB Flash area for customer data
- Protected Flash area
  128 Bytes for Keys, ID's, etc. can stored in a write- and clear-protectable region.
- Board Identify
  Vendor / Board / Serial number

3.14 Watchdog

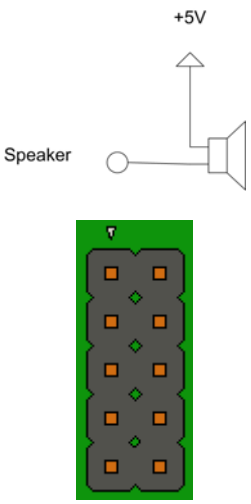
A watchdog timer is integrated on-board and managed by the LEMT. There are two different possibilities for its activation. One event is caused by under voltage protection.
The watchdog LED get flashed after restart, but only if the power supply had stood over 4,2 Volts.

The other watchdog event is triggered by internal circuit of the ITE8712 Super I/O. It is possible to program the trigger duration, see chapter 4.3 for an example.

3.15 Speaker

The speaker signal is located on the IDC10 Header PS/2. A standard PC Speaker can be connected between the signal SPEAKER and VCCKB.

Pin	Signal	Pin	Signal
1	Speaker	2	Mouse Clock
3	Reset-In	4	Mouse Data
5	KB Data	6	KB Clock
7	GND	8	+5 Volt Standby
9	Ext. Battery	10	Power Button (default)/ Reset-In

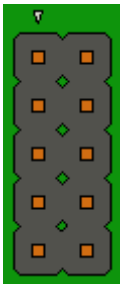


3.16 External Power-Button

The Power-Button signal is located on the IDC10 Header PS/2. To power up/down the board the signal Power-Button must be pulled to GND.

Connector type IDC10 pin header 2.54 mm

Pin	Signal	Pin	Signal
1	Speaker	2	Mouse Clock
3	Reset-In	4	Mouse Data
5	KB Data	6	KB Clock
7	GND	8	+5 Volt Standby
9	Ext. Battery	10	Power Button

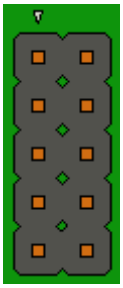


3.17 Reset-In Signal

The "Reset-In" signal is located on the IDC10 Header PS/2. To reset the board, the signal "Reset-In" must be pulled to GND.

Connector type IDC10 pin header 2.54 mm

Pin	Signal	Pin	Signal
1	Speaker	2	Mouse Clock
3	Reset-In	4	Mouse Data
5	KB Data	6	KB Clock
7	GND	8	+5 Volt Standby
9	Ext. Battery	10	Power Button

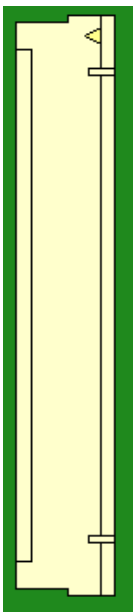


3.18 Supervisory

The Cool LiteRunner-LX800 provides a 25-pin Supervisory Connector on its bottom side. The table below shows the assignment of the different signals.

Connector type DF14 25 pin header 1.25 mm, single row

Pin	Signal	Pin	Signal
1	5V / 10mA	2	3,3V / 15mA
3	GPIO30[1]	4	GPIO31[1]
5	GPIO32[1]	6	GPIO33[1]
7	GPIO34[1]	8	GPIO35[1]
9	GPIO36[1]	10	GPIO37[1]
11	Suspend-LED[2]	12	Live-LED[2]
13	PME#[3]	14	ETH1 100MBit-LED[2]
15	ETH1 LINK/ACT[2]	16	Infrared-Send
17	Infrared-Receive	18	I^2C_CLK
19	I^2C_DATA	20	IDE_LED#[2]
21	RS485 TX+	22	RS485 TX-
23	RS485 RX+	24	RS485 RX-
25	GND		



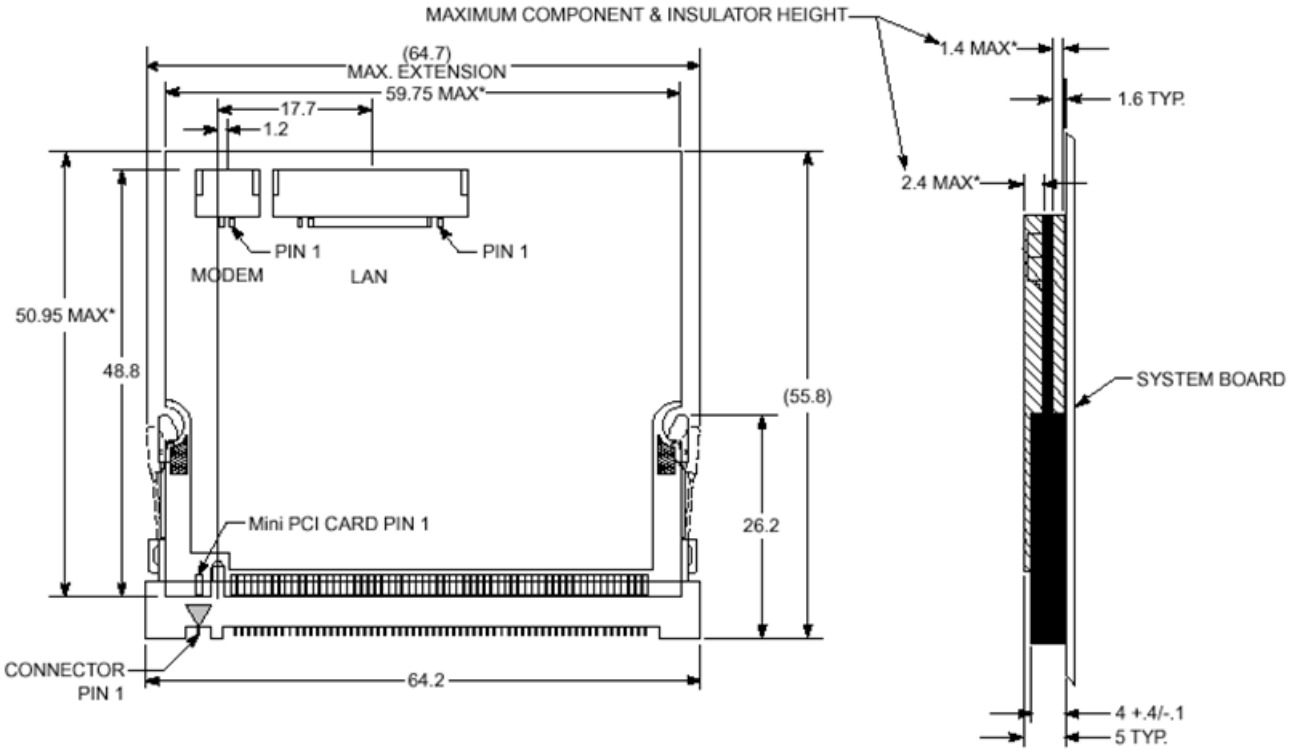
Notes:

(1) See chapter 4.2 about GPIO programming
(2) Connect cathode of LED to this pin. An external resistor is required.
(3) Power Management Signal

3.19 Mini-PCI BUS Interface

The Mini-PCI specification defines a small form factor daughter card for the 32bit PCI bus that can be used on CPU-boards in which standard PCI cards cannot be used due to mechanical constraints. A CPU board with such a card can easily be enhanced with new functionality. The onboard Type IIIA Mini-PCI Slot can be used to extend the system easily with peripheral functionality, like WLAN modules, Fire Wire-, Serial- and USB 2.0- ports.

Several Mini-PCI extension boards are available on request.



Pin	Signal	Pin	Signal
1	n.c.	2	n.c.
...	n.c.	16	n.c.
17	PCI_INTA#	18	5V
19	3.3V	20	PCI_INTB#
21	n.c	22	n.c.
23	GND	24	3.3V SBY
25	CLK_33_MPCI_R	26	PCI_RST#
27	GND	28	3.3V
29	REQ1_MPCI#	30	GNT1_MPCI#
31	3.3V	32	GND
33	PCI_AD31	34	PME#
35	PCI_AD29	36	n.c.
37	GND	38	PCI_AD30
39	PCI_AD27	40	3.3V
41	PCI_AD25	42	PCI_AD28
43	n.c.	44	PCI_AD26
45	PCI_C/BE3#	46	PCI_AD24
47	PCI_AD23	48	PCI_AD23
49	GND	50	GND
51	PCI_AD21	52	PCI_AD22
53	PCI_AD19	54	PCI_AD20
55	GND	56	PCI_PAR
57	PCI_AD17	58	PCI_AD18
59	PCI_C/BE2#	60	PCI_AD16
61	PCI_IRDY#	62	GND
63	3.3V	64	PCI_FRAME#
65	n.c.	66	PCI_TRDY#
67	PCI_SERR#	68	PCI_STOP#
69	GND	70	3.3V
71	PCI_PERR#	72	PCI_DEVSEL#
73	PCI_C/BE1#	74	GND

Pin	Signal	Pin	Signal
75	PCI_AD14	76	PCI_AD15
77	GND	78	PCI_AD13
79	PCI_AD12	80	PCI_AD11
81	PCI_AD10	82	GND
83	GND	84	PCI_AD09
85	PCI_AD08	86	PCI_C/BE0#
87	PCI_AD07	88	3.3V
89	3.3V	90	PCI_AD06
91	PCI_AD05	92	PCI_AD04
93	n.c	94	PCI_AD02
95	PCI_AD03	96	PCI_AD00
97	5V	98	n.c.
99	PCI_AD01	100	n.c.
101	GND	102	GND
103	n.c.	104	GND
105	n.c.	106	n.c.
107	n.c.	108	n.c.
109	n.c.	110	n.c.
111	n.c.	112	n.c.
113	GND	114	GND
115	n.c.	116	n.c.
117	GND	118	GND
119	GND	120	GND
121	n.c.	122	n.c.
123	5V	124	n.c.

Note: *All VI/O pins are connected to +3.3V.*
The maximum current is limited to 1.0 amp for each voltage.

3.20 PC/104 Bus Interface

The PC/104 bus is a modification of the industry standard (ISA) PC bus specified in IEEE P996. The PC/104 bus has different mechanics than P966 to allow the stacking of modules. The main features are:

- Supports programmable extra wait state for ISA cycles
- Supports I/O recovery time for back-to-back I/O cycles

The following table shows the pin assignment of the PC/104 connector.

Note: -5 V on the PC/104 connector is not supported on this board.

PC/104 Bus Connector

Pin	D	C
0	GND	GND
1	MEMCS16	SBHE
2	IOCS16	LA23
3	IRQ	LA22
4	IRQ	LA21
5	IRQ	LA20
6	IRQ	LA19
7	IRQ	LA18
8	DACK	LA17
9	DRQ	MEMR
10	DACK	MEMW
11	DRQ	SD8
12	DACK	SD9
13	DRQ	SD10
14	DACK	SD11
15	DRQ	SD12
16	+5V	SD13
17	MASTER	SD14
18	GND	SD15
19	GND	GND

Pin	A	B
1	IOCHCK	GND
2	D7	RSTDRV
3	D6	+5V see note
4	D5	IRQ9
5	D4	-5V
6	D3	DRQ2
7	D2	-12V see note
8	D1	ENDXFER
9	D0	+12V
10	IOCHRDY	KEY
11	AEN	SMEMW
12	A19	SMEMR
13	A18	IOW
14	A17	IOR
15	A16	DACK3
16	A15	DRQ3
17	A14	DACK1
18	A13	DRQ1
19	A12	REFRESH
20	A11	SYSCLK
21	A10	IRQ7
22	A9	IRQ6
23	A8	IRQ5
24	A7	IRQ4
25	A6	IRQ3
26	A5	DACK2
27	A4	TC
28	A3	BALE
29	A2	+5V
30	A1	OSC
31	A0	GND
32	GND	GND

4 Using the Module

4.1 BIOS

The Cool LiteRunner-LX800 is delivered with a Insyde Technology XpressROM BIOS. The default setting guarantees a "ready to run" system, even without a BIOS setup backup battery.

The BIOS is located in flash memory and can be easily updated on board with software under DOS.

All setup changes of the BIOS are stored in the CMOS RAM. A copy of the CMOS RAM, excluding date and time, is stored in the flash memory. This means that even if the backup battery runs out of power, the BIOS settings are not lost. Only date and time will be reset to their default value.

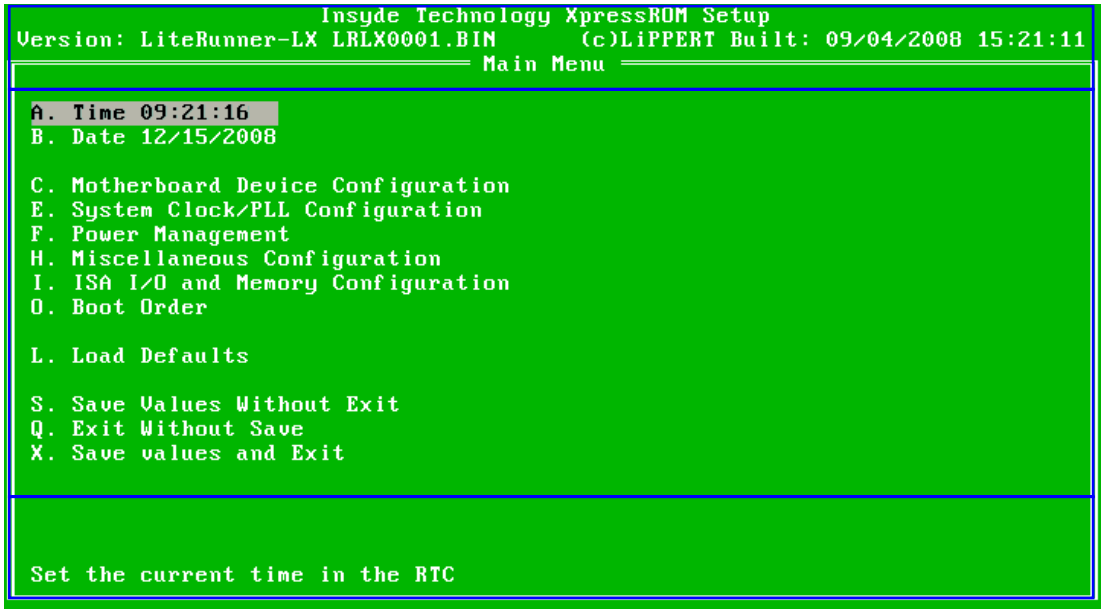
The soldered battery will keep that information over 3 years without any activation of the board. That depends on the use of the board. When power is up, the battery does not lose capacity.

With the Jumper "Battery", see chapter 2.2, the battery can be disconnected from the system. Because of the flash storage in the BIOS the settings will keep their information after. Except the Real Time Clock will not be up to date.

If the board should be stored for longer times, this is the best solution to save the capacity. The battery loses 1% of its capacity over self-discharge per year without the jumper.

Configuring the XpressROM BIOS

Pressing <F1> on power up starts the BIOS setup utility.


Insyde Technology XpressROM Setup
Version: LiteRunner-LX LRLX0001.BIN (c)LiPPERT Built: 09/04/2008 15:21:11
Main Menu
A. Time 09:21:16
B. Date 12/15/2008
C. Motherboard Device Configuration
E. System Clock/PLL Configuration
F. Power Management
H. Miscellaneous Configuration
I. ISA I/O and Memory Configuration
O. Boot Order
L. Load Defaults
S. Save Values Without Exit
Q. Exit Without Save
X. Save values and Exit
Set the current time in the RTC

On the screen there are three separated parts:

TOP

The part shows information over the current BIOS version. In brackets the name of the associate bin-file can be found. On the right side is the date when the file was built.

MIDDLE
Here are the different menus listed.

BOTTOM
A short information about the content of the selected menu is shown.

Field Selection

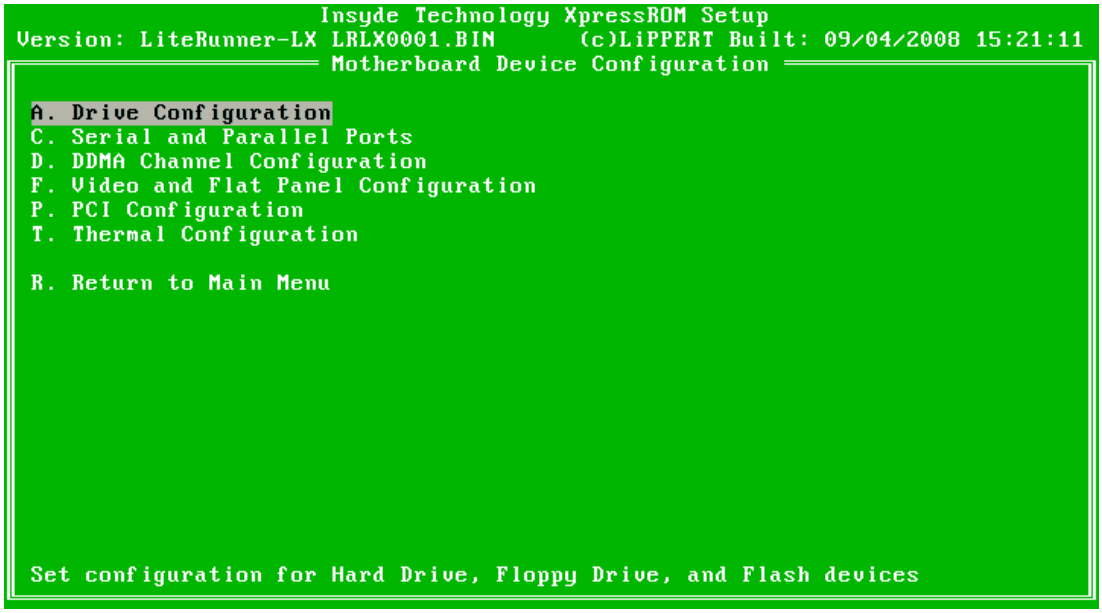
To move between fields in Setup, use the keys listed below:

Key	Function
→, ←, ↓, ↑	Move between fields
+, -	Selects next/previous values in fields
Enter	Go to the submenu for the field
Esc	To previous field then to exit menu

In order to save your settings, select ***Save values and Exit*** and confirm with Y.
Should you want to discard everything, select ***Exit Without Save***.

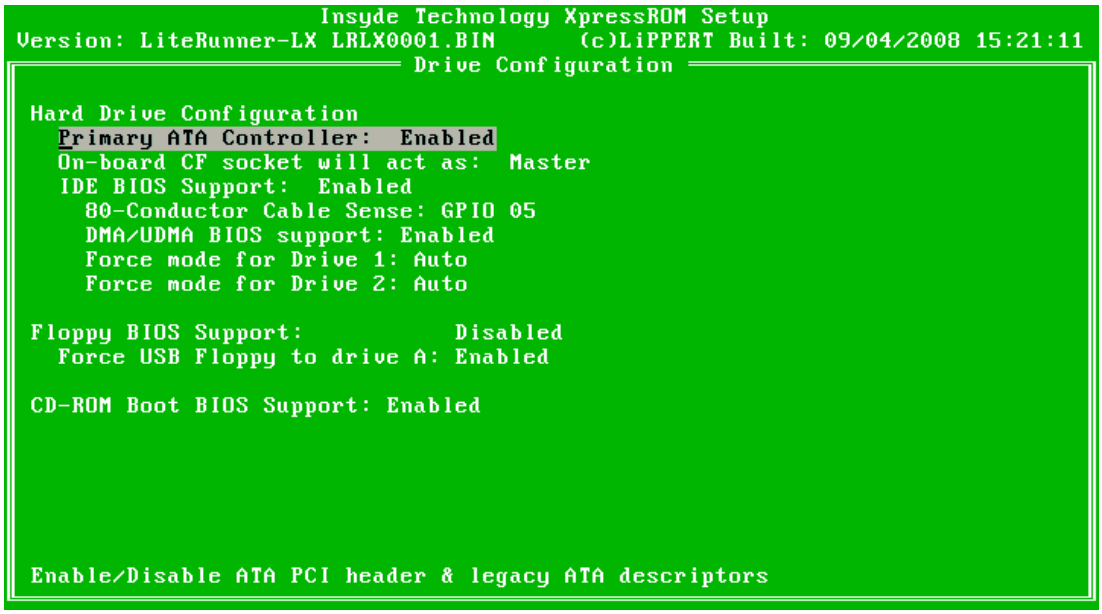
When troubleshooting a system, it is highly recommend to first restore the BIOS's factory settings before any debugging is done. This is achieved with ***Load Defaults*** in the main setup menu.

The ***Motherboard Device Configurations*** menu allows to configure the drives, LPC, DDMA, display, GPIO usage, and PCI configuration. The CPU's temperature can be read here, too.


Insyde Technology XpressROM Setup
Version: LiteRunner-LX LRLX0001.BIN (c)LiPPERT Built: 09/04/2008 15:21:11
Motherboard Device Configuration
A. Drive Configuration
C. Serial and Parallel Ports
D. DDMA Channel Configuration
F. Video and Flat Panel Configuration
P. PCI Configuration
T. Thermal Configuration
R. Return to Main Menu
Set configuration for Hard Drive, Floppy Drive, and Flash devices

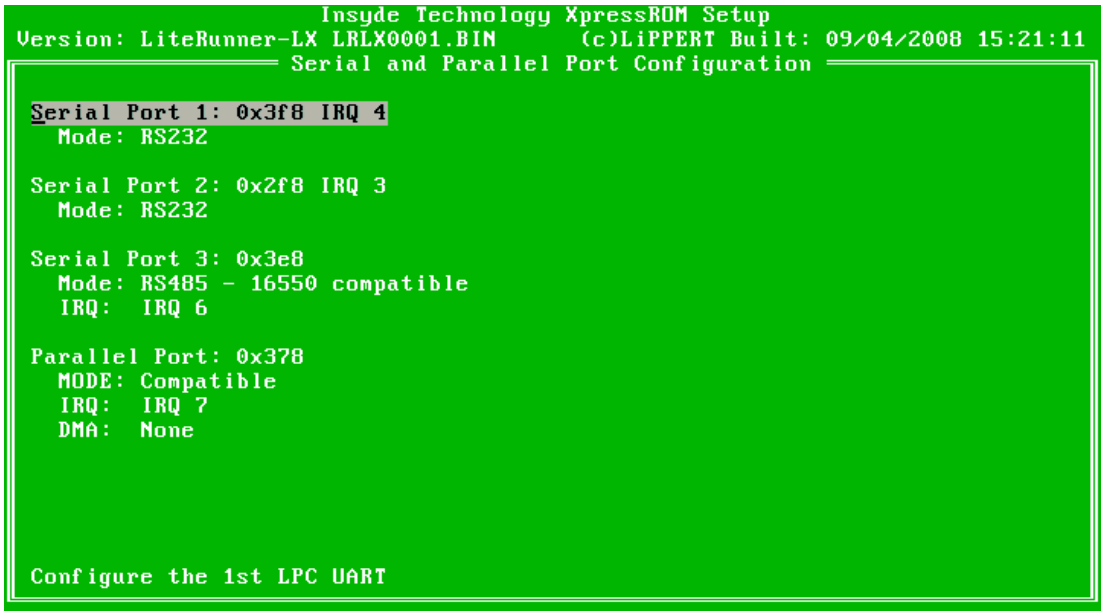
The ***Drive Configuration*** menu allows to configure connected EIDE devices.
An IDE device can be disabled that its power stays off after restart.

With the help of 80-Conductor Cable Sense the access system memory mode of an device is set. For running a device in UDMA-4 mode a 80 pin cable is required. The GPIO 05 option should detect that automatically. If it does not, there is the option to select it manually too.


Insyde Technology XpressROM Setup
Version: LiteRunner-LX LRLX0001.BIN (c)LiPPERT Built: 09/04/2008 15:21:11
Drive Configuration
Hard Drive Configuration
Primary ATA Controller: Enabled
On-board CF socket will act as: Master
IDE BIOS Support: Enabled
80-Conductor Cable Sense: GPIO 05
DMA/UDMA BIOS support: Enabled
Force mode for Drive 1: Auto
Force mode for Drive 2: Auto
Floppy BIOS Support: Disabled
Force USB Floppy to drive A: Enabled
CD-ROM Boot BIOS Support: Enabled
Enable/Disable ATA PCI header & legacy ATA descriptors

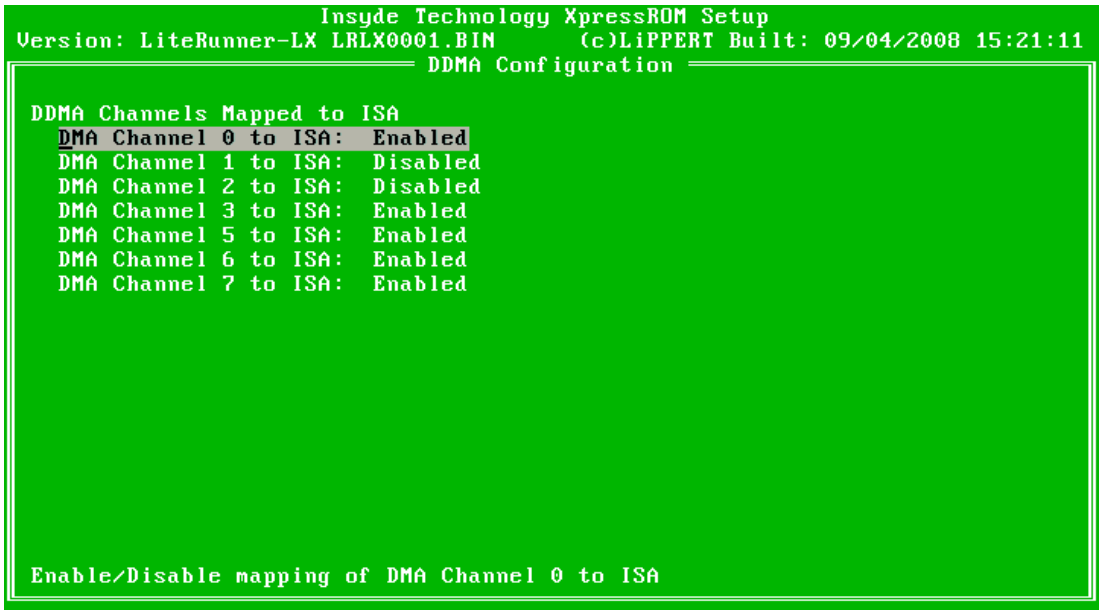
Hard Drive Setting	Options
80-Conductor Cable Sense	GPIO 05, NONE, Force 40, Force 80
Drive Modes	Auto, PIO0, PIO1, PIO2, PIO3, PIO4, MDMA0, MDMA1, MDMA2, UDMA0, UDMA1, UDMA2, UDMA3, UDMA4

The ***Serial and Parallel Device Configurations*** menu allows to configure COM1, COM2, COM3 and LPT1.
COM-Ports 1 and 2 can be switched between RS232 and RS485. It is possible to chance the resource and interrupts of all ports.

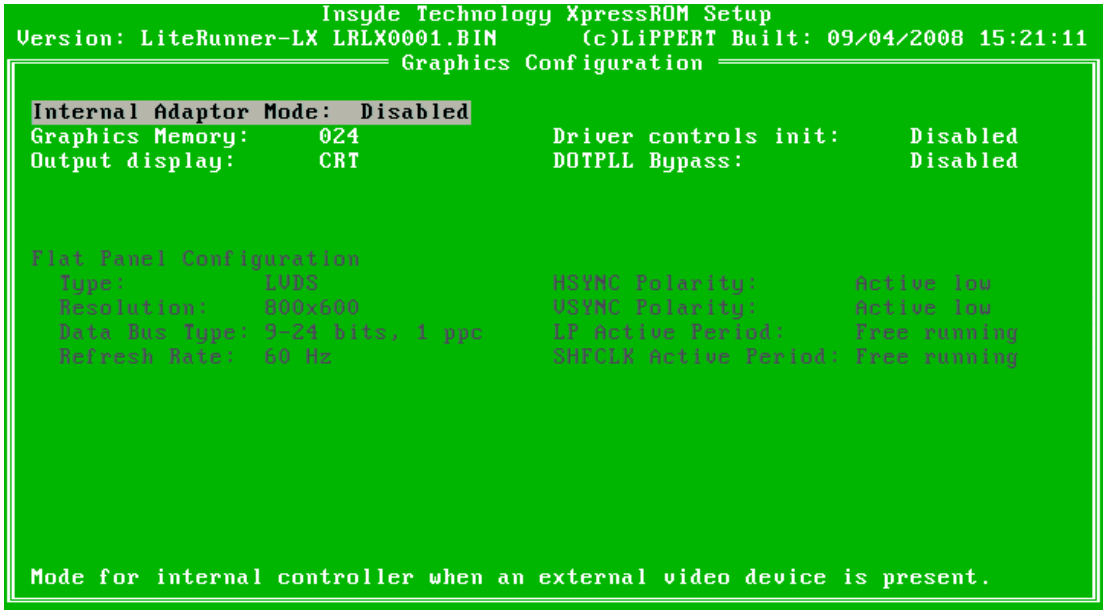


Hard Drive Setting	Options
Serial Port 1/2	Disabled, 0x3f8 IRQ 4, 0x2f8 IRQ 3, 0x3e8 IRQ4, 0x2e8 IRQ3
Serial Port 3	Disabled, 0x3f8, 0x2f8, 0x3e8 0x2e8 IRQ 5,6,7,9,10,11,15 SIR/CIR, RS485 16550 compatible, RS485 extended
Serial Mode	RS232, RS485
Parallel Port	Disabled, 0x378, 0x278, 0x3BC
Parallel Mode	Compatible, PS/2 Bi-directional, EPP 1.7, EPP 1.9, ECP
Parallel IRQ	Disabled, IRQ5, IRQ7, IRQ9, IRQ10, IRQ11
Parallel DMA	Channel 1, Channel 3, none

The ***DDMA Configuration*** menu allows to activate the DMA Mode for Channel 0 to 7.


Insyde Technology XpressROM Setup
Version: LiteRunner-LX LRLX0001.BIN (c)LiPPERT Built: 09/04/2008 15:21:11
DDMA Configuration
DDMA Channels Mapped to ISA
DMA Channel 0 to ISA: Enabled
DMA Channel 1 to ISA: Disabled
DMA Channel 2 to ISA: Disabled
DMA Channel 3 to ISA: Enabled
DMA Channel 5 to ISA: Enabled
DMA Channel 6 to ISA: Enabled
DMA Channel 7 to ISA: Enabled
Enable/Disable mapping of DMA Channel 0 to ISA

The ***Graphics Configuration*** menu allows to set up different displays and their several functions. Possible options are mentioned in chapter 3.4.


Insyde Technology XpressROM Setup
Version: LiteRunner-LX LRLX0001.BIN (c)LiPPERT Built: 09/04/2008 15:21:11
Graphics Configuration
Internal Adaptor Mode: Disabled
Graphics Memory: 024
Output display: CRT
Driver controls init: Disabled
DOTPLL Bypass: Disabled
Flat Panel Configuration
Type: LVDS
Resolution: 800x600
Data Bus Type: 9-24 bits, 1 ppc
Refresh Rate: 60 Hz
HSYNC Polarity: Active low
VSYNC Polarity: Active low
LP Active Period: Free running
SHFCLK Active Period: Free running
Mode for internal controller when an external video device is present.

The ***PCI Configuration*** menu contents options about PCI interrupts and USB.

There the PCI-ports can be referred to an interrupt.

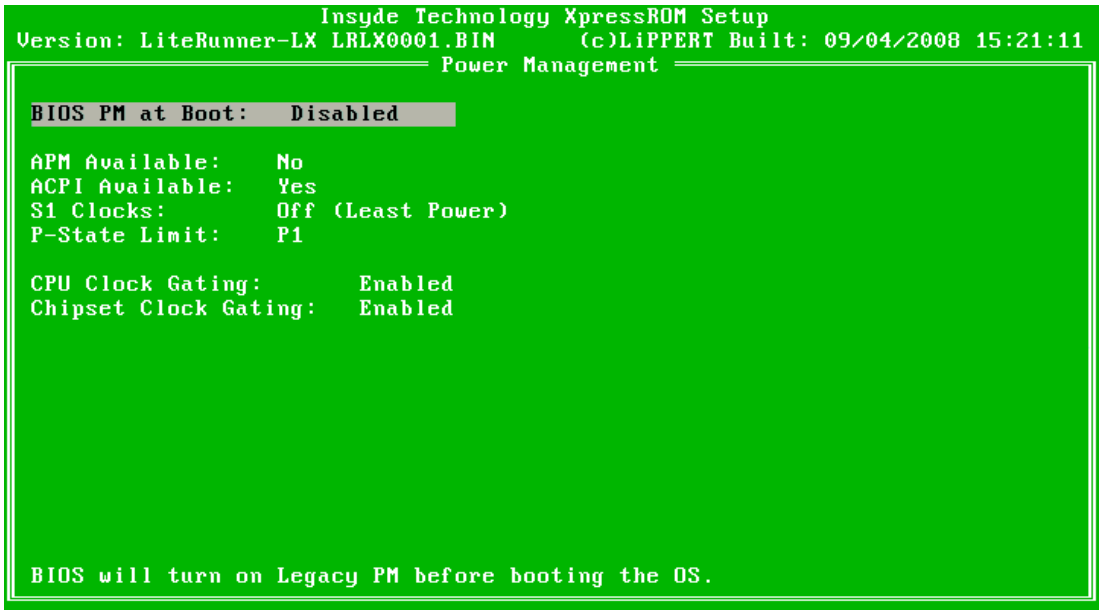
In the USB Settings the different controllers can be selected.
The port 4 can be changed to client mode.

The audio controller can be disabled if not needed.

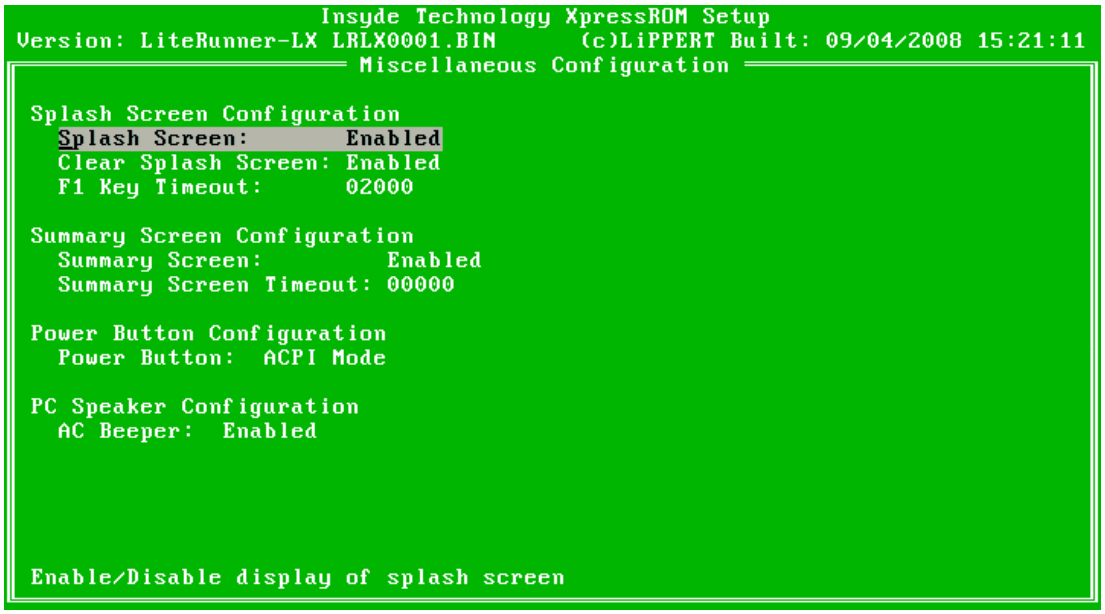
System Clock/PLL Configuration lets you define the CPU and PLL settings.

Insyde Technology XpressROM Setup
Version: LiteRunner-LX LRLX0001.BIN (c)LiPPERT Built: 09/04/2008 15:21:11
System Clock/PLL Configuration
Clock Mode
Clock Determined By: Manual Settings
Manual PLL Settings
CPU Multiplier: 15
GeodeLink Multiplier: 12
Spread Spectrum: Enabled
33.3MHz * CPU multiplier = CPU speed

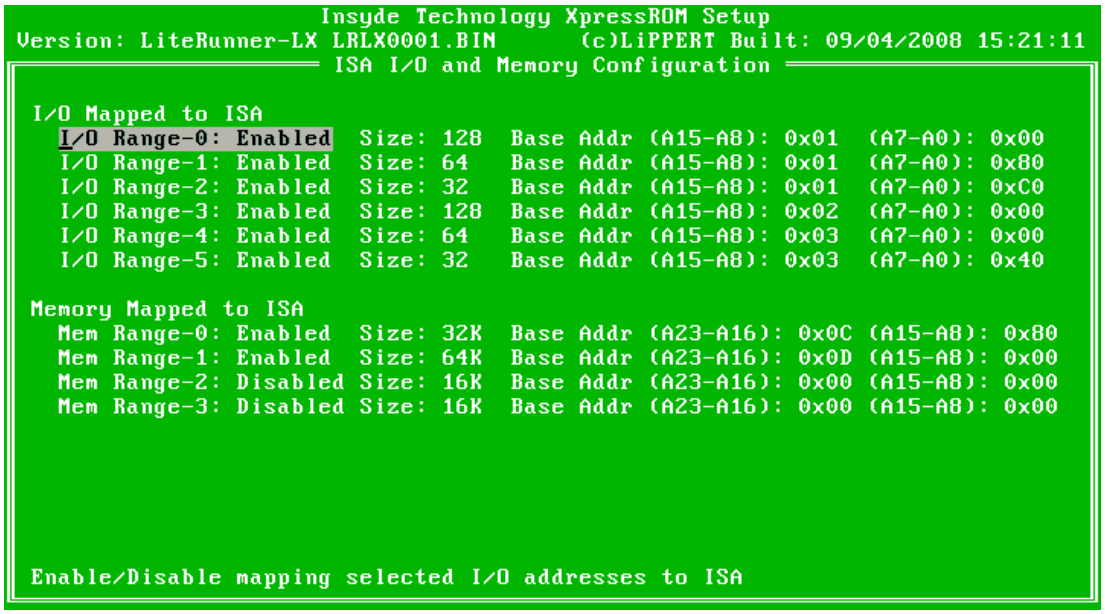
The ***Power Management*** menu gives control over power down modes supported.


Insyde Technology XpressROM Setup
Version: LiteRunner-LX LRLX0001.BIN (c)LiPPERT Built: 09/04/2008 15:21:11
Power Management
BIOS PM at Boot: Disabled
APM Available: No
ACPI Available: Yes
S1 Clocks: Off (Least Power)
P-State Limit: P1
CPU Clock Gating: Enabled
Chipset Clock Gating: Enabled
BIOS will turn on Legacy PM before booting the OS.

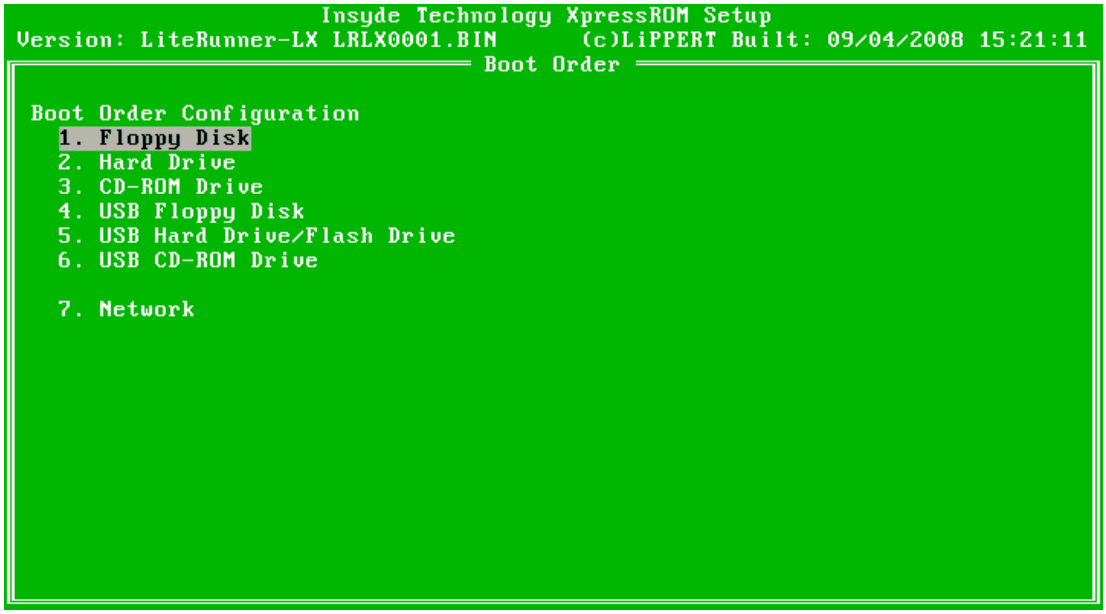
Miscellaneous Configuration controls various other features



ISA I/O and Memory Configuration allows setting the boards ISA memory and I/O map.

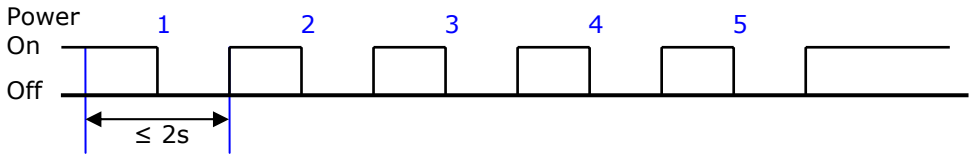

Insyde Technology XpressROM Setup
Version: LiteRunner-LX LRLX0001.BIN (c)LiPPERT Built: 09/04/2008 15:21:11
ISA I/O and Memory Configuration
I/O Mapped to ISA
I/O Range-0: Enabled Size: 128 Base Addr (A15-A8): 0x01 (A7-A0): 0x00
I/O Range-1: Enabled Size: 64 Base Addr (A15-A8): 0x01 (A7-A0): 0x80
I/O Range-2: Enabled Size: 32 Base Addr (A15-A8): 0x01 (A7-A0): 0xC0
I/O Range-3: Enabled Size: 128 Base Addr (A15-A8): 0x02 (A7-A0): 0x00
I/O Range-4: Enabled Size: 64 Base Addr (A15-A8): 0x03 (A7-A0): 0x00
I/O Range-5: Enabled Size: 32 Base Addr (A15-A8): 0x03 (A7-A0): 0x40
Memory Mapped to ISA
Mem Range-0: Enabled Size: 32K Base Addr (A23-A16): 0x0C (A15-A8): 0x80
Mem Range-1: Enabled Size: 64K Base Addr (A23-A16): 0x0D (A15-A8): 0x00
Mem Range-2: Disabled Size: 16K Base Addr (A23-A16): 0x00 (A15-A8): 0x00
Mem Range-3: Disabled Size: 16K Base Addr (A23-A16): 0x00 (A15-A8): 0x00
Enable/Disable mapping selected I/O addresses to ISA

The menu ***Boot Order*** specifies the order in which the BIOS tries the various mass memory devices for a bootable operating system. Boot over LAN is also supported.



Trouble Shooting BIOS Settings

It may happen that the BIOS is configured that the Cool LiteRunner-LX800 does not start at all. To repair this, the default values of the BIOS can be automatically loaded at boot time. To load these, the power must be switched on and off again within 2 seconds. This sequence must be repeated 5 times, then the default values get loaded by the BIOS.



Pressing the Reset-Button five times while the system is booting achieves the same result.

4.2 Programming GPIO Signals

The Cool LiteRunner-LX800 general purpose I/O signals (GPIO) are part of the ITE8712 SuperI/O. They are located in Logical Device 7 of the Super I/O and can be programmed using in/out statements on Index/Data registers 2Eh/2Fh. GPIO's 1x belong to GPIO set #1, GPIO's 2x to set #2 and so on, up to set #5. The following lines show an example how to program GPIO Bank 3, whose signals are located on the SUPERVISORY connector.

The code is meant to be compiled using gcc under Linux.

```
#include <sys/io.h>
#include <stdio.h>


#define CONF_ADDR 0x2E
#define CONF_DATA 0x2F
#define GPIO_ADDR 0x1220        //port address

//***********************************************************
// InitGPIO: initialize GPIO Bank #3
// Parameter: mode: bit=1 -> set to GPIO
//            dir:  bit=1/0 -> set to output/input
//            (char = 8 bit)
// Returns: -
//***********************************************************
void InitGPIO(char mode,char dir)
{
  // To set the SuperI/O into configuration mode, the sequence
  // 0x87, 0x01, 0x55, 0x55 must be written to the configuration address.
  outb(0x87, CONF_ADDR);
  outb(0x01, CONF_ADDR);
  outb(0x55, CONF_ADDR);
  outb(0x55, CONF_ADDR);
  // Enable Logical Device 7 for programming by writing 07h to
  // register 07h of the SuperI/O:
  outb(7, CONF_ADDR);           //Set to logic device
  outb(7, CONF_DATA);          //Number of logic device
  // Set GPIO-Set 3 Multifunction Pin Selection Register 27 to GPIO function
  // and enable the "simple I/O" function
  // Input: mode – each set bit represents a GPIO function
  outb(0x27, CONF_ADDR);      // set bank #3 to GPIO
  outb(mode, CONF_DATA);      // BIT: 1=GPIO , 0=other function
  // Define the GPIO's data direction
  // Input: dir – each set bit represents an output
  outb(0xCA, CONF_ADDR);      // set direction: output/input
  outb(dir, CONF_DATA);       // BIT: 1=output, 0=input
  outb(0xBA, CONF_ADDR);      // enable pull-ups if acting as output
  outb(dir, CONF_DATA);       // BIT: 1=pull up, 0=no pull up
}


int main()
{
  char value1=0x55,value2;    //8 bit values
  iopl(3);                    //get all I/O rights
  InitGPIO(0xff,0xff);        //Initialize GPIO:
                              //set all to GPIO and all to output
  outb(value1, GPIO_ADDR);    //write out value1
  printf("Write=%x", value1);
  value2 = inb(GPIO_ADDR);    //read in value2
  printf(", Read=%x\n", value2);
  return 0;
}
```

For a more detailed description about programming the ITE8712 super I/O, please refer to chapter 8 of the datasheet.

4.3 Programming Serial Port COM3

The transmitter of the RS485 interface must be disabled in receive mode, and enabled in transmit mode. The receiver has to be enabled in BIOS, by selecting the RS485 mode.

Therefore, setting GPIO2x of the ITE Super I/O
Bit 0 to '0' → disables transmitter, '1' → enables transmitter

The example is meant to be compiled using gcc under Linux.

```
#include <sys/io.h>
#include <stdio.h>


#define DATA_REG 0x1221     //Port addres for fast access to GPIO2x bank

void Com3Transmitter(unsigned char ON)
{
  unsigned char regval;

  if(ON)
    regval = inb(DATA_REG) | 1;   // enable COM3 RS485, Bit 0 of GPIO2x
  else
    regval = inb(DATA_REG) & ~1;  // disable COM3 RS485, Bit 1 of GPIO2x
  outb(regval, DATA_REG);
  printf("regval=%x   inb=%x\n",regval,inb(DATA_REG));
}

int main(int argc, char *argv[])
{
  unsigned char value;
  iopl(3);
  if(argc == 2)
  {
    value = strtol(argv[1], (char**)NULL,10);
    if(value == 0 || value == 1)
      Com3Transmitter(value);
    else
     printf("ERROR: wrong value\n");
  }
  else
    printf("USAGE: ./com3 <value>\nvalue = 0  -> OFF\nvalue = 1  -> ON\n");
  return 0;
}
```

4.4 LIVE LED Programming

The LIVE LED can be programmed by users. The cathode of the mounted LED is connected to a GPIO pin of the Super I/O. If the input has ground potential the LED is on.

That pin is set as simple I/O and can be easily reached over the port address.
The following program chances the state of the LIVE LED.

```
#include <stdio.h>
#include <sys/io.h>


#define PORT 0x1220


int main()
{
  unsigned char DATA, LED;
  iopl(3);


  LED = inb(PORT) && 0x01; //Mask the BIT 0 of GPIO1x bank
  DATA = inb(PORT);

  if(LED == 0x01)
  {
   printf("\nLIVE LED was OFF\n");
   outb(DATA - 1, PORT);
   printf("...");
   sleep(2);
   printf("\nSwitched it ON\n");
  }

  else
  {
   printf("\nLIVE LED was ON\n");
   outb(DATA + 1, PORT);
   printf("...");
   sleep(2);
   printf("\nSwitched it OFF\n");
  }

  iopl(0);
  return 0;
}
```

4.5 Watchdog Programming

Since the Watchdog is disabled in delivery status, it must be set up for proper use.

The Watchdog is an internal feature of the ITE8712 Super I/O. If the Watchdog is activated and the timer is not set back within a programmed amount of time, the board does a system reset. In order to read back the watchdog event read Bit 0 of Watchdog status register 71h in LDN7.

The following program in C is an example how to test Watchdog function under DOS.

This routine is meant to be compiled using gcc under Linux.

```
#include <stdio.h>
#include <sys/io.h>
#include <unistd.h>

#define CONF_ADDR 0x2E
#define CONF_DATA 0x2F

int main()
{
  unsigned char i;
  iopl(3);
  outb(0x87, CONF_ADDR); // sets SIO in configuration mode (fix sequence:
                         // 0x87,0x01,x055,0x55)
  outb(0x01, CONF_ADDR);
  outb(0x55, CONF_ADDR);
  outb(0x55, CONF_ADDR);
  outb(0x07, CONF_ADDR); // LDN=0x07
  outb(0x07, CONF_DATA);
  outb(0x72, CONF_ADDR); // set time out value to seconds
  outb(inb(CONF_DATA)|0x80, CONF_DATA);
  outb(0x73, CONF_ADDR); //set time out:
  outb(0x03, CONF_DATA); //0x03 -> 3 seconds
  printf("Watchdog enabled. Press CTRL+C within 5 seconds to stop resetting.\n");
  for(i=0; i<5; i++)
  {
    outb(0x73, CONF_ADDR); //reset time out
    outb(0x03, CONF_DATA);
    printf(".");
    fflush(stdout);
    sleep(1);
  }
  outb(0x73, CONF_ADDR);
  outb(0x00, CONF_DATA); //deactivate watchdog
  printf("\nWatchdog disabled\n");
  iopl(0);
  return 0;
}
```

4.6 Reading Temperatures

There are temperature sensors available that allow measurement of the CPU's chip temperature as well as the boards ambient temperature. These are shown in the BIOS setup screens, see above.

This example is meant to be compiled using gcc under Linux.

```
#include <stdio.h>
#include <unistd.h>
#include <sys/io.h>

#define LPC_INDEX 0x295
#define LPC_DATA 0x296

int main()
{
  char cputemp = 0;
  char ambtemp = 0;

  iopl(3);

  //******* needed with BIOS prior version 7 ******
  outb(0x51,LPC_INDEX); //thermal diode mode
  outb(0x03,LPC_DATA);
  outb(0x5C,LPC_INDEX); //unlock offset regs
  outb(0x80,LPC_DATA);
  outb(0x56,LPC_INDEX); //offset adjustment CPU
  outb(0x70,LPC_DATA);
  outb(0x57,LPC_INDEX); //offset adjustment Ambient
  outb(0x3C,LPC_DATA);
  outb(0x5C,LPC_INDEX); //lock offset regs
  outb(0x00,LPC_DATA);
  //***************************************

  printf("Press CTRL+C to cancel!\nCPU AMBIENT\n");
  while(1)
  {
    outb( 0x29,LPC_INDEX); //read out CPU temp
    cputemp = inb(LPC_DATA);
    outb( 0x2A,LPC_INDEX); //read out Ambient temp
    ambtemp = inb(LPC_DATA);
    printf("%3d %3d\r", cputemp, ambtemp); //printout to the screen
    fflush(stdout);
    sleep(1);
  }
  return 0;
}
```

4.7 Drivers

Software drivers for sound, Ethernet, AES and graphics adapter are available for the CLR-LX800.

These drivers can be downloaded from LiPPERT's website http://www.lippertembedded.com. Follow the installation instructions that come with the drivers.

5 Address Maps

This section describes the layout of the CPU memory and I/O address spaces.

Note *Depending on enabled or disabled functions in the BIOS, other or more resources may be used*

5.1 Memory Address Map

Address Range		Address Range (Hex)			Size	Description
1024K	- 16384K	100000	-	FFFFFF	15360K	Extended Memory
960K	- 1023K	F0000	-	FFFFF	64K	System BIOS
936K	- 959K	EA000	-	EFFFF	24K	Unused
932K	- 935K	E9000	-	E9FFF	4K	ACPI
896K	- 931K	E0000	-	E8FFF	36K	Unused
800K	- 895K	C8000	-	DFFFF	96K	Mapped to ISA bus
768K	- 799K	C0000		C7FFF	32K	Graphics BIOS
736K	- 768K	B8000	-	BFFFF	32K	Color Text Memory
704K	- 736K	B0000	-	B7FFF	32K	Monochrome Text Memory
640K	- 704K	A0000	-	AFFFF	64K	Graphic Memory
0K	- 640K	0	-	9FFFF	640K	Conventional Memory

5.2 I/O Address Map

The system chip set implements a number of registers in I/O address space. These registers occupy the following map in the I/O space.

Address Range	Description
0000 - 000F	DMA-Controller
0020 - 0021	Programmable Interrupt controller
002E - 002F	System
0040 - 0043	System timer
0048 - 004B	System timer
004E - 004F	Super I/O
0060 - 0060	Keyboard
0061 - 0061	System speaker
0064 - 0064	Keyboard
0070 - 0073	System CMOS/Real-time clock
0080 - 008F	DMA-Controller
0092 - 0092	System
00A0 - 00A1	Programmable Interrupt controller
00C0 - 00DF	DDMA-Controller
00F0 - 00FF	Numeric Coprocessor
0100 - 017F	PCI-ISA Bridge Positive Decode Range 1
0180 - 01BF	PCI-ISA Bridge Positive Decode Range 2
01C0 - 01CF	PCI-ISA Bridge Positive Decode Range 3
01F0 – 01FF	IDE Controller
0200 - 027F	PCI-ISA Bridge Positive Decode Range 4
0279 - 0279	ISA-PnP-Data port
0295 - 0296	LPC-Bus
02F8 - 02FF	COM2
0300 - 033F	PCI-ISA Bridge Positive Decode Range 5
0340 - 035F	PCI-ISA Bridge Positive Decode Range 6
0378 - 037F	LPT1
03B0 - 03BA	Advanced Micro Devices Win XP Graphics Driver
03C0 - 03DF	Advanced Micro Devices Win XP Graphics Driver
03F0 - 03F7	Standard-Floppy controller
03F8 - 03FF	COM1
0480 - 048F	DMA-Controller
04D0 - 04D1	Programmable Interrupt controller
0A79 - 0A79	ISAPnP-Data port
1200 - 1207	SPI-Flash
1220 - 1227	Simple-I/O (default)
DF80 - DFFF	Not used
EFF0 - EFFF	Standard-Dual-Channel-PCI-IDE-Controller

5.3 Interrupts

IRQ	System Resource	BUS
NMI	Parity error	-
0	Timer	-
1	PS/2 Keyboard	LPC
2	(Secondary interrupt controller 2)	-
3	Serial port 2	LPC
4	Serial port 1	LPC
5	PCI INTC# (ETH0)	PCI
6	Serial port 3	PCI
7	Parallel port 1	LPC
8	Real time clock	-
9	ACPI controller	LPC
10	PCI INTA# (Mini-PCI, AES, Grafik)	PCI
11	PCI INTB# (Mini-PCI, Audio)	PCI
12	PS/2 Mouse	LPC
13	Numeric coprocessor	PCI
14	Primary IDE channel	PCI
15	PCI INTD# (ETH1, USB)	PCI

Note Depending on the BIOS settings, it's possible to reserve several IRQ's for Mini PCI bus.
Devices over PCI- and LPC- bus cannot share one interrupt together!

5.4 DMA Channels

DMA	Data width	System Resource
0	8 bits	Available
1	8 bits	Available
2	8 bits	Available
3	8 bits	Parallel Port
4		Reserved, Cascade Channel
5	16 bits	Available
6	16 bits	Available
7	16 bits	Available

5.5 PC/104 Bus Address Space

The PC/104 bus address space mapping can be changed in the BIOS setup. The table shows the factory default values.

Range	Start Address	End Address	Size	Description
I/O 0	100	17F	128 bytes	IT8712 Positive Decode I/O Range 1
I/O 1	180	1BF	64 bytes	IT8712 Positive Decode I/O Range 2
I/O 2	1C0	1DF	32 bytes	IT8712 Positive Decode I/O Range 3
I/O 3	200	27F	128 bytes	IT8712 Positive Decode I/O Range 4
I/O 4	300	33F	64 bytes	IT8712 Positive Decode I/O Range 5
I/O 5	340	35F	32 bytes	IT8888 Positive Decode I/O Range 6
Mem 0	C8000	CFFFF	32 Kbytes	Memory mapped to ISA
Mem 1	0D000	DFFFF	64 Kbytes	Memory mapped to ISA
Mem 2	-			Disabled
Mem 3	-			Disabled

Appendix A, Contact Information

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Appendix B, Additional Information

B.1 Additional Reading

AMD Geode™ LX Processors Data Book

AMD Geode™ CS5536 Companion Device Data Book

Datasheet LPC interface ITE IT8712F, available at http://www.ite.com.tw

B.2 PC/104

A copy of the latest PC/104 can be obtained from the PC/104 Consortium's website at http://www.pc104.org

Appendix C, Getting Help

Should you have technical questions that are not covered by the respective manuals, please contact our support department at **support@lippertembedded.com** .

Please allow one working day for an answer!

Technical manuals as well as other literature for all LiPPERT products can be found in the *Products* section of LiPPERT's website www.lippertembedded.com. Simply locate the product in question and follow the link to its manual.

Returning Products for Repair

To return a product to LiPPERT for repair, you need to get a Return Material Authorization (RMA) number first.
Please print the RMA Request Form from http://www.lippertembedded.com/service/repairs.html fill in the blanks and fax it to +49 621 4321430. We'll return it to you with the RMA number.

Deliveries without a valid RMA number are returned to sender at his own cost!

LiPPERT has a written Warranty and Repair Policy, which can be retrieved from http://www.lippertembedded.com/service/warranty.html

It describes how defective products are handled and what the related costs are. Please read this document carefully before returning a product.

Appendix D, Revision History

Filename	Date	Edited by	Change
TME-104-CLR_LX800-R0V0	2008-05-14	CS	preliminary draft
TME-104-CLR-LX800-R1V0	2008-12-23	MF	Minor corrections
TME-104-CLR-LX800-R1V1	2008-01-08	CS	Ch. 1.4 dimensions added
TME-104-CLR-LX800-R1V2	2009-02-13	CS	Ch. 4.5 program failure corrected
TME-104-CLR-LX800-R1V3	2009-03-11	CS	Ch. 1.3, max. current corrected, footnote added